> Custodial Trust has sought to consider the fiduciary, environmental, regulatory, economic and other impacts that the Proposed Plan for clean-up of the Aberjona River may have on the three beneficiaries of the Custodial Trust. For the record, the Custodial Trust also shares the multi-stakeholder goal of achieving the earliest possible clean-up for the benefit of the public at large."

EPA Response: Comments on the enforcement process are outside the scope of this responsiveness summary, which addresses comments on the Proposed Plan. EPA further notes that it does not agree with the Custodial Trust's characterization of its role with regard to Industri-plex OU-2. The Custodial Trust's fiduciary obligations relate to holding, managing and selling Mark Phillips Trust property, and distributing proceeds from the sale of that property under the 1989 Consent Decree, and to provide EPA access to the property it holds in trust. The Consent Decree does not create any fiduciary obligations for the Custodial Trust relative to the implementation of Industri-plex OU-2.

> A.5 A resident of Wilmington asked where information will be kept and whether the information will be accessible to the public.

EPA Response: The Administrative Record will be kept and maintained at the Woburn Public Library, Woburn, MA, and EPA's Record Center, Boston, MA.

B. Questions and Comments Regarding Institutional Controls

> B. 1. Many commenters expressed concern that institutional controls could create a stigma regarding their property, making it difficult to sell or finance those properties.

EPA Response: EPA identified in the Feasibility Study (FS) and Proposed Plan various alternatives for addressing risks associated with various media. For groundwater (GW-2 and portion of GW-4 for West Hide Pile (WHP)), surface soils (SS), subsurface soils (SUB), and deeper wetland sediments (DS), EPA selected institutional controls. For surface soils (SS) and subsurface soils (SUB), other alternatives were evaluated, such as soil excavation, which if selected may not require institutional controls. However, selecting such an option would significantly increase costs, as well as increase business disruptions during remedy implementation. EPA's selected remedy includes institutional controls that will prevent exposures to contamination above cleanup standards and protect the remedy, where necessary. The selected remedy is also cost effective and causes minimal disruptions to active business operations at the properties requiring action. While EPA appreciates the concerns expressed, the alternatives which incorporate institutional controls will have the most minimal economic impact on the affected properties. EPA is committed to developing minimally-intrusive institutional controls which will attain the remedial action objectives. The form of institutional controls will be determined during pre-design and design in accordance with guidance, policies and regulations. EPA will work closely with state and local officials and impacted landowners on the implementation of institutional controls.

B. 2. Several landowners questioned whether or not institutional controls could be imposed on their properties if they are not liable for response costs under CERCLA. Several commenters also suggested that EPA rely upon the Activity and Use Limitations ("AULs") or other land use restrictions permitted in Massachusetts under Massachusetts General Laws, Chapter 21E.

EPA Response: EPA has not yet determined the type of institutional controls that may be implemented as part of the remedy. The specific type or types of institutional controls will be determined during the pre-design and design phase. EPA notes that while some landowners may be not be subject to liability under CERCLA, CERCLA does require non-liable parties to cooperate in cleanup efforts, including the implementation of institutional controls. See Section J for responses regarding liability.

B. 3. The consultant hired by the ASC commented that: "[t]he Massachusetts Contingency Plan specifies that groundwater aquifers are considered State resources and its foreseeable use is therefore determined by the State, not by individual property owners. Institutional controls, therefore, cannot be placed on groundwater unless the State designates these groundwater areas as inappropriate for the uses that pose risk in the human health risk characterization."

EPA Response: The MassDEP conducted a use and value determination of the aquifer within the Northern Study Area (north of Interstate 95), and determined the groundwater to be of "low use and value." The Commonwealth of Massachusetts has worked in consultation with EPA during the preparation of the risk assessments and agrees that the risk assessments are consistent with their Method 3 approach. EPA's baseline risk assessment identified the groundwater plumes as contributing to future risks to commercial/ industrial workers and excavation workers. EPA's selected remedy identifies institutional controls for groundwater to reduce those future human health risks. Under CERCLA, EPA has the authority to take action to limit exposures to groundwater at a site. In this case, institutional controls will be the vehicle to ensure that specified groundwater uses are restricted.

B. 4. MassDEP commented that: "DEP supports institutional controls (ICs) in concept for the areas outlined in the Proposed Plan because of the future risk these areas present. However, it has not been possible for DEP to fully evaluate the proposed ICs because EPA did not identify the types of ICs with sufficient specificity, nor compare and contrast the efficacy of different types of ICs in the feasibility study (FS). In addition, the FS did not appropriately assess the timing or who will be responsible for securing, maintaining and enforcing the ICs (for example, in the FS Table 4-2D that evaluates ICs for surface soils under the 9 criteria, a time frame is not estimated, and it is incorrectly stated that no coordination among agencies will be required). If these issues are not addressed prior to the ROD, the ROD should then not be limited to a particular type of IC (such as a Grant).

In review of the IC issues for the Proposed Plan, DEP referred in part to EPA's final fact sheet titled "Institutional Controls: A Site Manager's Guide to Identifying, Evaluating and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups" EPA 540-F-00-005, OSWER 9355.0-74FS-P dated September 2000 which specifically addresses all the issues mentioned."

The consultant for the Woburn City Council commented that it needed more details concerning monitoring and costs in order to evaluate the proposed institutional controls.

EPA Response: Institutional controls will be developed and established to prevent exposures to contamination above cleanup standards and protect the selected remedy, where necessary. EPA believes that it is appropriate in this case to leave the exact form of institutional controls to the pre-design and design process, so that controls can be developed with the input of stakeholders, and in accordance with relevant guidance, policies and regulations.

B. 5. MassDEP commented that: "[s]ince the decision to place ICs for future dredging on a portion of the HBHA wetland was based on the assessment of a single core, DEP recommends leaving flexibility in the remedy decision for further investigation of that area that may reveal that an alternative remedy (e.g. excavation rather than ICs) may be a better option."

EPA Response: EPA collected four sediment core samples within the HBHA Wetland. The decision for institutional controls was based upon the exposure point concentrations at SC02. The area warranting institutional controls was extended to the next sediment core samples (SC01 and SC03). Pre-design sediment core investigations may be implemented to further define the institutional controls boundaries within the HBHA Wetlands. However, if a responsible party opted for removal of contaminated sediments, then institutional controls may not be required, providing that provisions were implemented to prevent future recontamination from upstream sources.

B. 6. MassDEP commented that because only a few properties will be in need of an additional groundwater restriction under Industri-plex OU-2 and because groundwater is mobile and restrictions on groundwater should be temporary measures, EPA should perform a full evaluation of alternatives to a Grant of Environmental Restriction for those few properties involved.

EPA Response: Considering that waste will remain in place at the Industri-plex site and this waste directly contributes to the contaminated groundwater plumes, EPA does not believe that the institutional controls will be temporary. Institutional controls will be developed and established to prevent exposures to contamination above cleanup standards and protect the selected remedy, where necessary. The form of institutional controls will be determined during the pre-design and design in accordance with relevant guidance, policies and regulations, which will include a review of alternatives to grants of environmental restrictions.

B. 7. MassDEP commented that two alternatives would increase protectiveness immediately, and eliminate the need for ICs on several properties: excavation and removal of surface soil on only vacant properties, or excavation and removal of surface soil in the area indicated in the plan, excluding the sub-surface contaminated area. Subsequently, ICs would only be placed on the subsurface contaminated soil area.

EPA Response: EPA's selected remedy requires institutional controls in the subsurface soil (SUB) area and surface soil (SS) area. The smaller SS area is situated within the boundaries of the SUB area. Removing portions of the SS area will not eliminate the need for institutional controls within that area (SUB area will still require institutional controls). In addition, EPA's selected remedy addresses the remedial action objectives and is cost effective. MassDEP's suggestion to excavate portions of the soils from the SS area will significantly increase costs while not eliminating the need for institutional controls.

B. 8. Cummings Properties (Cummings) inquired as to whether several properties it owns would be subject to institutional controls under the Proposed Plan.

EPA Response: EPA has identified to Cummings which properties owned by Cummings would be subject to institutional controls. EPA's responses are contained in the administrative record.

B. 9. The ASC's consultant asked who would be responsible for overseeing compliance with institutional controls, and further if there were any rules or regulations governing institutional controls. A resident from Wilmington also asked who would be responsible for the controls.

EPA Response: The selected remedy requires further coordination with the state, local officials and impacted landowners, as well as further predesign investigations to determine the extent of institutional controls. While the responsible parties may bear responsibility for monitoring compliance with institutional controls, EPA, the Commonwealth of Massachusetts and/or the City of Woburn will likely enforce and oversee the implementation of the institutional controls. Once designed, the affected current and future property owners will be required to comply with the institutional controls. The implementation of institutional controls is governed in part by the above-mentioned document entitled "Institutional Controls: A Site Manager's Guide to Identifying, Evaluating and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups" EPA 540-F-00-005, OSWER 9355.0-74FS-P dated September 2000 (EPA IC Guide) and relevant provisions of the Massachusetts Contingency Plan.

B. 10. The MBTA asked EPA to provide details of the institutional controls and monitoring program, whether access to contaminated areas will be limited by fencing, and if so, where the fencing is proposed.

EPA Response: EPA's selected remedy does not include fencing to restrict access to contaminated areas. Institutional controls will be developed and established to prevent exposures to contamination above cleanup standards and protect the selected remedy, where necessary. The form of institutional controls will be determined during the pre-design and design in accordance with relevant guidance, policies and regulations.

B. 11. The Woburn City Council commented that: "EPA makes repeated references to Institutional Controls and we understand that they will be used for Industri-plex. However, the City has never been included in the EPA's discussions and communications about these Institutional Controls, nor has the EPA taken the time to explain what, according to TOSC, will be complex land use restrictions that will necessarily involve local government. When will EPA be explaining these to us? Who will be responsible for regulating, maintaining, and enforcing such controls for decades to come? What will the associated costs be? Who will bear the costs?"

EPA Response: In order to protect human health by controlling potential exposures to contaminated soils, sediments, and groundwater, the selected remedy relies on the use of institutional controls such as land and groundwater use restrictions. Institutional controls are also necessary for the protection of the selected remedy. The details of the institutional controls will be determined during the pre-design and remedial design phase in coordination with the parties performing the remedial action, impacted landowners, and local officials. MassDEP participation with the institutional controls will be in accordance with the Commonwealth of Massachusetts policies, guidance and regulations.

C. Questions and Comments Concerning the Impact of Flooding on the Remedy and Concerning the Upper Mystic Lake

C. 1. The City of Woburn, The Town of Winchester, the Mystic River Watershed Association and the ASC asked EPA to consider the impact of flooding on any proposed remedy. The Woburn City Council asked whether the Preferred Remedy would alter flood storage capacity.

EPA Response: EPA's selected remedy is not expected to reduce flood storage capacity within the watershed. EPA's selected remedy requires the construction of compensatory wetlands to mitigate for any loss of wetland functions and values caused by the remedy, including flood storage. The final compensatory wetland design may actually improve and increase the overall net flood storage capacity within the watershed. EPA's remedy will comply with all regulations and substantive permit requirements, including Section 404 of the Clean Water Act and the Executive Order for Floodplain Management, Exec. Order 11988 (1977), codified at 40 C.F.R. Part 6, App. A., 40 CFR 6.302(b). In addition, the surface water control structure (i.e., culvert) at Mishawum Road controls flooding conditions within HBHA and regulates surface water flow downstream. EPA's remedy does not alter this control structure. Limited excavations along the perimeter of the Wells G&H Wetland and Cranberry Bog Conservation Area will be restored to match the existing conditions. EPA's selected remedy is not expected to interfere with or compromise surface water flow conditions downstream in Winchester.

C. 2. The ASC asked EPA to provide a clear delineation of health risks posed by contamination deposited on frequently flooded areas, including several playing fields in Winchester. The ASC's consultant questioned why EPA did not sample in floodplain areas where the ASC had requested sampling during the Remedial Investigation, and stated that sampling results collected to date mandated the need for further sampling.

EPA Response: EPA conducted extensive soil and sediment sampling along frequently flooded areas of the Aberjona River. Extensive sampling was conducted near all of the areas identified in the comment that are prone to flooding including Davidson Park, Wedgemere Station, and Ginn Field. EPA believes that these samples are representative of the conditions affected by episodic flooding and determined there were no unacceptable human health or ecological risks at any of these areas. The collection of surface soil samples within the floodplain, but within 10 and 50 feet of the river or wetland areas, represents a worst-case approach since contaminant levels in soil are likely to display decreasing concentrations with increasing distance from the river channel. This investigation has consistently revealed relatively low concentrations of contamination in these frequently flooded areas, and risk evaluations consistently concluded the areas do not pose a current or future unacceptable human health or ecological risk. These investigation efforts implemented for Industri-plex OU-2 (including Wells G&H OU-3) were significant and sufficient at assessing and evaluating the nature and extent of contamination, fate and transport process, and risks along the river. EPA does not plan on conducting further soil or sediment sampling along the Aberjona River for further risk assessment calculations. EPA's selected remedy will require further surface water monitoring along the Aberjona River, and periodic sediment monitoring at the Upper Mystic Lake and upper and lower forebays (see response to Comment C.8).

C. 3. The ASC's consultant commented that updated floodplain information be used to delineate areas to be sampled and monitored.

EPA Response: EPA targeted sediment and soil sampling in areas of significant deposition and high flood frequency based upon inspection and observations of the river, and discussions with the public. EPA also referenced the 1980 FEMA flood maps relative to our inspections and observations of the river. The frequently flooded areas were sampled.

C. 4. The MBTA asked for the flooding criteria that were considered to assess stream levels during storm events and design of the impermeable cap along stream bed (New Boston Street Drainway) to the west of the MBTA railroad tracks.

EPA Response: The conceptual design for the liner of the stream channels assumes that the stream bed will be excavated in order to install the liner and preserve the current elevations and volume capacity of the existing stream channels. A pre-design investigation is intended to evaluate flood storage issues and serve as part of the design basis for the final remedial design. The specific design details will be specified in the remedial design.

C. 5. The MBTA asked what precautions were being taken to help ensure that stormwater flooding will not cause structural damage to the railroad tracks.

EPA Response: A pre-design investigation will evaluate flood storage issues and serve as part of the design basis for the final remedial design. The design details will be specified in the remedial design.

> C. 6. The Town of Winchester requested the opportunity to confer with EPA on the potential impact of the proposed remedy on its flood control projects.

EPA Response: EPA will continue to coordinate with the Town of Winchester regarding the selected remedy, including its impact on flood control.

> C. 7. Stauffer Management Company LLC ("SMC"), Pharmacia Corp. ("Pharmacia") and consultants retained by SMC and Pharmacia commented that EPA has proposed to alter significantly the HBHA Pond without regard for flood control in the area, and will exacerbate flooding conditions. The RTC Realty Trust (the "RTC") noted that the proposed alternative has the potential to significantly alter the surface flow regime in the area of the HBHA, and asked for more study or explanation to address the potential for flooding.
>
> The RTC also noted that one of the EPA presentations mentioned that high storm flows into the HBHA "break down the chemocline, stir up the bottom sediments, and "flush" contaminated sediments downstream," and asked if the proposed alternative addresses this transport mechanism, and whether consideration was given to sending some stormwater flow around the upper HBHA retention area and directly into the lower portion of the HBHA.

EPA Response: EPA evaluated the flood storage design which was approved by the United States Army Corps of Engineers ("USACE") in the early 1970s. EPA disagrees with the comment which suggests that the HBHA will be significantly altered by the selected remedy and could have flooding implications as far reaching as Winchester. Storm flows will continue to be mitigated by both the north and south basins of the HBHA Pond. However, the HBHA Pond only represents about 25 percent of the entire HBHA storage area and storm flows will continue to be mitigated by the entire HBHA, not just the HBHA Pond, as was originally designed. Under the selected remedy, no modifications to the HBHA are planned beyond the HBHA Pond. The outlet structure at Mishawum Road will still function as the main control point for retaining storm flows within the HBHA. See also Response to Comment C.1.

The baseflow inputs from Halls Brook and a portion of the storm flow will continue to flow into the primary treatment area/cell (northern/first low-head cofferdam) of the HBHA Pond. Consequently, storm flows will continue to be mitigated by both the north (primary and secondary treatment cells) and south portions (restored area) of the HBHA Pond. It is also important to note that the flood control structure located at the southern tip of the HBHA Wetlands (at Mishawum Road) will not be altered under the selected remedy.

Nonetheless, EPA recognizes that potential flood impacts are an important design consideration for both downstream and upstream areas. These issues will be fully addressed in a pre-design investigation so that these potential impacts can be mitigated by the final remedial design.

The selected remedy for the HBHA Pond will effectively address the contaminated groundwater plumes discharge into the HBHA Pond, and effectively treat/sequester contamination so that the surface water effluent at the outlet of the secondary treatment cell complies with surface water cleanup standards.

C. 8. Friends of Upper Mystic Lake asked for more information/predictions (modeling) on the impact of the proposed remedy on the Upper Mystic Lake, particularly the upper forebay and the sediments in the lake, and a plan for continued monitoring of the Upper Mystic Lake, particularly the upper forebay and the sediments in the lake.

EPA Response: EPA conducted extensive sediment sampling within the upper forebay of the Upper Mystic Lake and determined that no unacceptable human health or ecological risks currently exist in the upper forebay. EPA's selected remedy will require further surface water monitoring along the Aberjona River, and periodic monitoring of sediments in the Upper Mystic Lakes and associated upper and lower forebays. EPA expects the surface water monitoring to be similar to the surface water monitoring conducted during the MSGRP RI, and that these data can be compared to the MSGRP RI results including those for the Upper Mystic Lake. The surface water data will also be applied to June 2005 surface water model to draw further comparisons. Sediment grab samples will also be periodically collected in a manner similar to the MSGRP RI from the Upper Mystic Lakes and upper and lower forebays.

D. Questions and Comments Concerning Human Health and Ecological Risk Assessments

D. 1. The ASC's consultant inquired as to the governing standards for cleanups at properties impacted by the remedy, i.e., Massachusetts Contingency Plan ("MCP") standards versus cleanup standards calculated by EPA. The ASC's consultant further commented that because the acceptable cancer risk set forth in the MCP is ten times more stringent than the acceptable risk relied upon by EPA in setting cleanup goals for the Aberjona River, EPA must work collaboratively with MassDEP to insure that the Commonwealth's interests are furthered with this cleanup, such that additional work will not be required after the federal cleanup is completed.

EPA Response: EPA has coordinated closely with MassDEP throughout the RI/FS process, including the baseline risk assessments. MassDEP considers the risk assessment methods used under this RI/ FS process to be equivalent to the MCP Method 3 risk assessment. MassDEP also considers remedial decisions selected by this ROD, upon their concurrence, to be adequately regulated.

D. 2. The ASC's consultant asked whether the proposed remedy is "safe," and commented that because "EPA has chosen to meet the least stringent level of its range of acceptable risks, there is little room for error in the implementation of its plans if the target risk range is to be truly met. Consequently, every step should be subject to comprehensive evaluation and scrutiny. If the plan goes forward as proposed (or even with minor modifications), the continued process of public participation is crucial to its

> success. In fact, there should be more opportunities for public participation in the remedial design and decision-making process."

EPA Response: The cleanup standards in the Record of Decision correspond to a level of risk that is lower than the "least stringent level of its range of acceptable risks," such that the cumulative risk will be within EPA's overall target risk management range. EPA agrees the public involvement is important to the success of the remedy. Any significant modifications to the remedy will be subject to the public participation processes required by the NCP. The selected remedy is a cost effective solution that will adequately reduce risks identified at the site. Hence, the selected remedy will effectively manage the contamination and risks posed by the site, be constructed in accordance with Federal Occupational Health and Safety Administration (OSHA) requirements, and function in a protective and safe manner. The Superfund process allows for public participation in all aspects of the program. Continued monitoring and evaluation of the remedy implemented will be a necessary part of remedial design, remedial action and long-term monitoring.

In addition, a comprehensive review will be conducted at least every five years to evaluate the protectiveness of the remedy. The purpose of the five-year review is to evaluate the implementation and performance of the remedy in order to determine if the remedy is or will be protective of human health and the environment. The five-year review will document recommendations and follow-up actions as necessary to ensure long-term protectiveness of the remedy or bring about protectiveness of a remedy that is not protective. These recommendations could include providing additional response actions, improving O&M activities, optimizing the remedy, enforcing access controls and institutional controls and conducting additional studies and investigations.

> D. 3. The ASC's consultant commented that "the additional tables and calculations presented by EPA in the September 2004 update to the Baseline Human Health and Ecological Risk Assessment Report are not consistent and suggest potential omissions. Table 3-3.4 lists the exposure point concentrations used in the calculations. Problematically, the sampling locations listed in Table 3-3.4 differ from those mentioned in the text of the report and subsequent tables. The sampling locations included in Table 3-3.4 are NR, WS/WSS, CB-05, DA, KF, and 07/DP. Page ES-3 and other places in the report claim that the residential calculations were performed for locations WS/WSS, CB-05, KF, 07/DP, and AJRW. Thus, the NR and DA locations in Table 3-3.4 were not used in subsequent tables and calculations, and the AJRW location (the only one that represents actual soil data) was evaluated instead (though not included in the exposure point concentration Table 3-3.4)."
>
> The ASC's consultant further commented that the omission of sampling locations DA and NR from the residential evaluation in the Human Health Risk Assessment must be explained, because the residential risk estimates for these stations exceed EPA's acceptable risk management criteria.

EPA Response: EPA established a recreational frequency of exposure for stations NR and DA considering a number of factors, including land use and accessibility, and evaluated potential risks based upon the exposure point concentrations for average and reasonable maximum concentrations. As a result, the human health risk assessment did not identify these areas as associated with an unacceptable risk based on a future recreational scenario. The evaluation of potential residential exposures to surface soil that may have been impacted by flooding was specifically evaluated for locations in Winchester, the locale of concern based on previously provided community comments. Locations in Woburn were also included as considered applicable. Table 3.3-4 is correct in the listing of stations with available surface soil data. The text is correct in identifying which of those stations with available surface soil data have been quantitatively evaluated for this potentially complete residential pathway. Station AJRW exposure point concentrations are provided on Table 3.3-7. It was not an unexpected finding that stations NR and DA had the highest arsenic levels of all the surface soil samples. The surface soil samples from these two stations were collected from areas where the river bank was highly channelized, and a steep drop down to the river bed was present. The soil samples were collected at the very edge of the channel, immediately at the top of the river bank, rather than 10 to 50 feet from the waters edge as noted for surface soil samples collected from the other stations. Because the soil samples collected from stations NR and DA are representative of river bank data rather than floodplain soil data, they were not included in the residential evaluation.

> D. 4. The ASC's consultant commented that: "[i]n many cases, EPA evaluates target-specific hazard indices to gauge the significance of non-cancer health risks. Each chemical is assigned to a specific category of potential adverse health impacts based on the nature of the toxicity data used to derive its reference dose (safe exposure level). However, the target-specific analyses incorrectly assume that each chemical has one and only one endpoint via which it can cause adverse health impacts. In some cases, chemicals can cause multiple adverse health effects at different levels of exposure. In cases where the aggregate hazard index (summed over all chemicals) exceeds one and EPA has developed target-specific analyses for which the disaggregated hazard indices are all smaller than one, EPA should evaluate secondary endpoints for chemicals that might contribute risk to the critical health endpoint . . . By not considering the potential effects of chemicals on non-target organs, EPA has underestimated potential risks."

EPA Response: Each contaminant has one or, in some cases, a small number of target organs, i.e., organs adversely affected by a contaminant at levels slightly above the threshold dose for that compound. It is acknowledged that other organ systems may be affected by specific contaminants; however, the effects on non-target organs occur at higher levels of exposure. In selecting target organs, the most sensitive organ(s) are identified, not all organs that may be affected at all exposure doses. In addition, the hazard posed by two compounds with the same target organ should only be summed if those two compounds also exert toxicity through the same or a similar mechanism of action. The approach used in this risk assessment conforms to the EPA method of estimating target organ hazard indices.

> D. 5. The ASC's consultant commented, regarding the possibility of deep sediment contamination ecological impact, that: "EPA did not justify its decision not to sample sediment depths lower than 6 inches. In the current BERA, this problem has continued. In Appendix E.4 – Baseline Ecological Risk Assessment Supplemental Data of the Baseline Human Health and Ecological Risk Assessment Report – concentrations of

> Contaminants of Potential Concern (COPCs) from 1-2 foot, 2-3 foot and 3-4 foot were not presented nor discussed in the text. The concern of re-suspension of deep sediments that may be contaminated was not addressed. Deeper contamination in sediments may exist beyond Reach 1, but the data have not been provided. Additionally, no remediation is proposed beyond Reach 0. Risk management actions, such as land use restrictions, could be taken to prevent scouring and erosion of contaminated deeper sediments."

EPA Response: The purpose of the baseline ecological risk assessment was to assess risk to organisms exposed to surface sediments. Deep sediment is not a medium typically available for exposure to aquatic organisms; therefore a scenario involving exposure to ecological receptors was not evaluated. None of the scenarios included a pathway for exposure of organisms to deep sediments, and did not require an evaluation of risk to media that is not normally exposed to ecological receptors. In addition, the data collected in the sediment cores did indicate that, in general, there are lower concentrations of sediment contaminants in deeper sediments.

> D. 6. The ASC's consultant commented that: "[t]he exposure model used for the Green Heron (Metcalf & Eddy, 2004; pages 4-55 to 4-56) does not accurately estimate its exposure. Because herons seek favorable foraging areas and do not wander far, exposures should be expressed by reach rather than site-wide. Their foraging areas can be small – for example, a shoreline of a wetland or along a wetland channel; yet, small fish data collected site-wide were used to estimate that fish represent 45% of a heron's diet. Because a value of 55% was used in the exposure model for the invertebrate proportion of a heron's diet, more crayfish data should be collected from reaches not sampled (see Davis and Kushlan, 1994)."

EPA Response: The limited site-specific tissue data utilized in the BERA was sufficient to estimate exposures to avian species. The major COPCs of concern (metals) are not bioaccumulative. The conservative estimate of dietary exposure used the maximum site-wide concentration of each COPC (highest of all the crayfish and fish tissue concentrations). Based on this dose estimate, only iron exceeded the NOAEL level (M&E, 2004, Table 4-194). Although the assessment endpoint is not to determine risk to an individual, this estimate assumes that the exposed individual ate only the most contaminated crayfish and fish in the whole study area every day. Using these data, there is no evidence of potential effects on avian populations. EPA considers the estimates of risk from dietary exposures to be conservative, appropriate, and protective.

> D. 7. The ASC's consultant commented that: "[b]ecause muskrat exposures and risks were calculated on a station-by-station basis (page 4-57), the same comments regarding the Green Heron and the inadequate crayfish data also apply to muskrats."

EPA Response: The limited site-specific tissue data for crayfish was also adequate for muskrat modeling, for different reasons. Muskrats are herbivores, and the dietary dose of animal tissue (represented by crayfish) is only 10% of the diet. Improvements in the estimate of the COPC concentrations in crayfish would not have substantially changed the risk estimates. EPA believes that the estimates of dietary exposures for muskrat were appropriate.

> D. 8. Relative to the number of crayfish collected from various reaches, the ASC's consultant commented that: "only two samples were collected from reaches 1 and 2, three from reach 3, one from reach 5, and no samples at all from reaches 4 and 6. These are extremely small crayfish data sets for reaches that measure at least 100 feet each in length. In Table 2-179, the average arsenic concentration in crayfish was 2.7 mg/kg in reach 2, 1.5 mg/kg in reach 3, and 0.24 mg/kg in reach 5. This latter value was the arsenic concentration in a single crayfish. Additionally, the average concentration of contaminants in crayfish is used to assess risk in each reach. Although this provides a best estimate of risk, due to the limited nature of the data, it would be more conservative and more protective of the environment to use the maximum detected concentrations.
>
> Although no crayfish samples were collected from reaches 4 and 6, dietary exposures associated with ingestion of crayfish were calculated for these areas using data from reaches 3 and 5. Using crayfish body burden data from another reach to represent potential crayfish body burdens in reaches 4 and 6 does not provide useful information that can aid in making a risk management decision."

EPA Response: The limited site-specific tissue data for crayfish were adequate for modeling of wildlife exposures, and EPA considers the dietary exposure estimates associated with ingestion of crayfish to be appropriate and protective. The major COPCs of concern (metals) are not bioaccumulative, and the limited tissue data, even using the maximum site-wide concentrations of metals in crayfish tissue, did not result in risk to receptors.

> D. 9. The ASC's consultant commented that: "plant uptake factors based on a small number of plant samples were applied to plants in all areas considered in the ecological risk assessment. Six plant samples were collected from stations in the 38-acre wetland of reach 1. Plant tissue data are not available for the other 5 reaches. Using average plant uptake values derived from another reach to represent potential plant tissue concentrations for the other five reaches will not provide useful information that can aid in making a risk management decision."
> (The ASC's consultant made this comment with regard to both the September 2004 Ecological Risk Characterization and the MSGRP Ecological Risk Assessments)

EPA Response: Although the data set is not large, EPA did collect site-specific data for concentrations of COPCs in plant tissue. Data were collected in the reach with the highest observed contaminant concentrations, and the potentially largest area of habitat for herbivores (Reach 1). Utilizing these site-specific data for the other reaches is a reasonable estimate of plant uptake, and the uncertainty in these extrapolations was discussed in the BERA.

> D. 10. The ASC's consultant commented that: "although the EPA collected media-specific data for the ecological risk assessment, EPA did not necessarily collect the most appropriate data. For example, in evaluating potential dietary risks to the muskrat, EPA sampled cattails, the muskrat's primary food item. Instead of sampling the roots and basal portions of the plants eaten by muskrats (as stated on page 4-38), however, EPA sampled the stems and leaves of the cattails."

EPA Response: Samples of plant tissue were collected to estimate dietary exposure of both muskrat and mallard in food-chain models. It is correct that EPA collected above-ground portions of plants for plant tissue analysis. This was done in part to allow these values to be used as estimates for mallard consumption as well, for which it would not be generally appropriate to use root portions of the plant. As is true for most food-chain modeling, the best available data were used as an estimate in the models. EPA acknowledges that the utilization of stem/leaf samples likely underestimated dietary exposure of muskrat to metal COPCs. However, plant tissue concentrations were not measured at each station, but rather estimated from sediment concentrations. Evaluation of the potential error in this estimate of plant tissue concentrations for sediment concentrations and BCFs, is provided in Table 4-276 of the BERA (M&E, 2004). There is uncertainty involved in each assumption, and EPA attempted to use the data in a consistent and reasonable manner. The issue of above-ground portions of the plant and root tissue was further addressed in the BERA for the Northern Study Area (Appendix 7A, TTNUS, 2005) and in the comprehensive risk assessment (Chapter 7 of the RI, TTNUS, 2005).

> D. 11. The ASC's consultant commented that: "[e]xposure COPC doses for plant ingestion (page 4-58) should not be modeled for the muskrat because the risk assessment should represent realistic and site-specific exposures. The use of plant tissue concentrations that were modeled from average station sediment COPC concentrations for each habitat (pond, wetland, or river) multiplied by site-wide uptake factors is appropriate for a screening-level assessment, but not a baseline risk assessment."

EPA Response: Calculating risk to wildlife using dietary models with site-specific tissue data is standard practice. In the Northern Study Area, additional plant tissue data were collected and utilized to assess dietary dose to muskrat in Reach 0, as well as to assess the uncertainty in the application of uptake factors. Estimates for muskrat were not made using site-wide sediment concentrations; the estimates in reaches 1-6 were based on station-specific sediment concentrations and uptake factors. Utilizing uptake factors, which were based on site-specific data, is a reasonable estimate of plant uptake, and the uncertainty in these extrapolations was discussed in the BERAs.

> D. 12. The ASC's consultant commented that: "eels were caught in the fish survey but were not used in the Risk Assessment. Though eels are a key species in the study area, no justification is provided for the exclusion of eels from the study. Eels have a higher lipid content than the white sucker, a species that was considered in the study, and could therefore contain higher concentrations of lipophilic chemicals. The eel should replace the white sucker in the Risk Assessment. Eels should additionally be used in the small fish tissue data used to calculate dietary fish exposure for the heron."

EPA Response: There were 17 white sucker samples in the Southern Study Area as compared to 5 eel samples (all from reach 6). Only 4 eels were captured in the Northern Study Area and all of them were in Philips Pond, which is a reference pond. No eels were captured in HBHA Pond or HBHA pond No. 3. White sucker was selected as a reasonable receptor to evaluate potential tissue residue effects since more data were available and more tissue residue values were available from similar species. Although eels may have higher lipid content, the major COPCs were metals, which are not lipophilic, and do not generally bioaccumulate through the food web.

D. 13. The ASC's consultant commented that: "[c]opper could be responsible for adverse health effects in benthic invertebrates and perhaps fish as well. The average concentration of 49.7 mg/kg in crayfish is approximately twice the laboratory test concentration at which no effects were observed (page 4-72). The on-site tissue concentration of copper was 2.5 times higher than the reference samples.

Additionally, evaluation of sediment chemistry indicated that high concentrations of arsenic, copper, chromium, mercury, and zinc were correlated with both (a) those sites with evidence of reduced growth of benthic invertebrates in toxicity tests, as well as (b) those stations with evidence of impacted natural communities (page 4-85)."

EPA Response: EPA has acknowledged that the potential impairment of benthic invertebrate communities correlated to arsenic as well as other metals in sediment. However, the potential effects on benthic organisms were most highly correlated to arsenic concentrations. The conclusions regarding the magnitude and significance of the risk to benthic communities is not altered by attributing the risk to one or more metals detected in the sediments.

D. 14. The ASC's consultant commented that: "[t]he text (page 4-88) appears to be incorrect or the calculations are incorrect for the risks to the muskrat. The text states that a test TRV for arsenic is based on a chronic (reproductive) lowest observed adverse effect level (LOAEL) in a mouse of 1.93 mg/kg-day, but a test TRV value of 1.26 mg/kg-day appears in Table 4-142.

In addition, the text states that the 'TRV is based on oral doses of sodium arsenite which is likely to be more toxic than forms found in the muskrat diet on-site. Due to these uncertainties, the confidence in the conclusion of risk to muskrat is reduced.' However, 3.3 % of the diet is associated with ingestion of sediment, either in the pond or wetlands, which may be in arsenite form."

EPA Response: It is acknowledged that the text on page 4-88 is incorrect. The muskrat arsenic TRVs used in calculations were not based on a TRV of 1.93 mg/kg-day but in fact were based on a LOAEL of 1.26 mg/kg-day as indicated in Table 1-142 and the muskrat food chain models. Since the TRV which was used in the calculations is lower than the TRV mistakenly printed in the text, risk conclusions would not change.

The TRV is based on oral does of sodium arsenite, which is a more toxic form of arsenic. By using sodium arsenite, rather than another form of arsenic, the model ensures that risk from arsenic will not be underestimated.

D. 15. The ASC's consultant commented that: "[t]he derived Wildlife TRV value of 7 mg/kg-day for chromium (page 4-89) does not appear to be the most conservative value. A test TRV of 5 mg/kg-day for a mouse is listed in Table E.3.1 and represents a reproductive endpoint. Using this value, a wildlife TRV would be 2 mg/kg-day and would be a more reasonable estimate to use for the muskrat. It is likely that chromium could be a risk driver for the muskrat because the 3-fold difference between the two wildlife TRVs would elevate the hazard index by a factor of 3."

EPA Response: As stated in the text on page 4-60 of the subject document, a TRV based on a LOAEL was used only if a suitable NOAEL was unavailable. The derived Wildlife TRV value of 7 mg/kg-day was obtained from a NOAEL study 20 weeks in duration. The 2 mg/kg-day value was obtained from a LOAEL study of shorter duration (12 weeks), and thus required a downward adjustment correction factor of 10. The original 7 mg/kg-day TRV was, therefore, more suitable.

D. 16. The ASC's consultant commented that: "EPA's conclusion that there is no evidence of negative impacts on the survival, growth, or reproduction of green heron populations or other piscivorous birds resulting from the exposure to COPCs in the study area (page 4-92) is flawed.

EPA's conclusion may be inaccurate for the following reasons:

- Exposure calculations do not adequately reflect realistic exposures for green herons.
- Table 4-251 indicates that the average arsenic concentration of 0.3 mg/kg in blue gills for the study area is 3-fold higher than the reference, but the concentrations detected in each reach are not presented.
- Table E.2-2 shows that arsenic concentrations in brown bullhead tissue are significantly greater than the reference concentrations.
    - The average arsenic concentration of 0.14 mg/kg in brown bullhead fillets from Reach 3 was 3-fold higher than the reference concentration of 0.042 mg/kg.
    - The average arsenic concentration of 1.2 mg/kg in brown bullhead offal from Reach 3 was 27-fold larger than the reference concentration of 0.046 mg/kg.
    - The average arsenic concentration of 0.17 mg/kg in brown bullhead fillets from Reach 6 was 4-fold higher than the reference concentration.
    - The average arsenic concentration of 0.096 mg/g in brown bullhead offal from Reach 6 showed a 2-fold increase relative to the reference.

In addition, differences in COPC concentrations in crayfish, small fish, and bottom feeding fish within reaches should be compared because risk management decisions will need to be made by reach. Some areas may not be suitable for aquaculture."

EPA Response: EPA used consistent and conservative exposure assumptions. When the maximum case exposure scenario was calculated for heron (Table 4-194 in M&E, 2004), the only COPC with an HQ above 1 was iron. This conservative exposure scenario assumes that the heron feeds exclusively on fish and crayfish with maximum observed concentrations of each COPC observed in the study area. Based on this dose estimate, only iron exceeded the NOAEL level (M&E, 2004, Table 4-194). Although the assessment endpoint is not to determine risk to an individual, this estimate assumes that the exposed individual ate only the most contaminated crayfish and fish in the whole study area every day. Using these data, there is no evidence of potential effects on avian populations. EPA considers the estimates of dietary exposures to be conservative, appropriate, and protective.

Elevated concentrations of COPCs in tissue of fish on site as compared to reference locations may lead to a conclusion of increased exposure to arsenic, but not necessarily the presence of an ecological effect. The ecological effects endpoint was a comparison to tissue residue concentrations that are indicative of toxicity or impairment to fish.

A comparison of tissue concentrations for crayfish and fish among reaches was not part of an assessment endpoint that would assist in the determination of risk to aquatic receptors. The tissue data collected were used to address the assessment endpoints identified in the risk assessment.

> D. 17. The ASC's consultant commented that: "EPA is incorrect in concluding that 'there is relatively high confidence in the mallard TRV used for arsenic since it is based on the same species for a chronic exposure (page 4-93).
>
> The test TRV of 5.14 mg/kg-day for arsenic selected for the mallard and heron was derived from a mortality endpoint, not a chronic endpoint such as reproduction or growth. A lower test TRV of 3 mg/kg-day is cited in Table E.3.2 and is from a recent study (Camardese et al., 1990).
>
> It is a flawed rationale to conclude, 'The exposure analysis indicates that a portion of the potential mallard habitat may be impacted within the Wells G&H wetland. However, the limited area of arsenic above 1,000 mg/kg is not sufficient to represent a threat to mallard populations within the wetland, even if the ducks limited foraging to this wetland exclusively.' The exposure and risk model for the mallard only examines the exposure and risks to the adults, not fledglings which limit their foraging to the immediate vicinity of the nest. If fledglings from the nests in the Wells G&H wetland don't survive due to the effects caused by arsenic, this could have a dramatic effect on the local mallard population.
>
> Feathers could easily be collected from nests in nearby heron colonies or mallard nests in the HBHA wetlands or the Wells G&H wetland, and they could subsequently be analyzed for arsenic to assess their exposure and risk."

EPA Response: The test TRV of 5.14 mg/kg-day for arsenic selected for the mallard and heron was derived from a mortality endpoint for a 128-day test. Whereas, the Camardese et al., (1990) TRV is based on 70-day tests. Using either value for the TRV, the assessment endpoint for mallards would not be exceeded. The Camardese et al., (1990) reference is based on ducklings, so this TRV incorporates the concern for protecting fledglings.

Based on the nature of the COPCs, and level of risk to avian species, EPA did not consider that additional studies on exposures of herons were necessary. In addition, unless there are TRVs in the literature relating arsenic concentrations in feathers to effects on reproduction, growth, or mortality in avian species, collecting these types of data would not assist in determining effects, only in assessing exposure.

> D. 18. The ASC's consultant commented that: "only sediment samples beneath less than three feet of water were used to evaluate exposure of mallard ducks to sediment. The justification and references for this threshold should be elucidated. Also, many species of ducks live on Mystic Lake for at least a portion of the year. Because it is the largest open water body in the Aberjona River watershed, exposures for mallards in Mystic Lake should be calculated separately. Sediment sampling location SD-02-01 was used to evaluate exposure of a muskrat to sediment, but was not used to evaluate mallard exposure."

EPA Response: Mallards are dabbling ducks. Water depth for feeding and brooding is typically listed as from 1 foot to up to 3 feet deep (Johnson et al., 1987). Up to 2.0 to 2.5 feet deep may be more typical for mallards; however, since water levels may vary annually, EPA considered less than 3 feet a reasonable estimate of forage depth for a dabbling duck. (This response was provided previously in the response to Zemba, et al. (2003)).

Mallard use of Mystic Lakes was included in the site-wide model. Based on the depth, sediment sample SD-02-01 should have been used for mallard exposure calculation, and was corrected in Table 4-32 (M&E, 2004). The sitewide model was re-calculated with this sample; and the revised results were presented inTables E.1-51, E.1-52, 4-198 and 4-199 of the 2004 BERA (M&E, 2004). Table 4-197 (M&E, 2004), which summarized HQs for mallard, did not require revision, as none of the HQs, rounded to whole numbers, differed from the previously reported values.

EPA used consistent and conservative exposure assumptions. Modeling potential risk to mallard in a subbasin (Mystic Lakes) of the study area would not alter the risk conclusions.

> D. 19. The ASC's consultant commented that: "EPA may be incorrect to state that 'the survival or reproduction of shrew may be impaired in the study area due to exposure to inorganics in diet, but the results are associated with moderate level of uncertainty' (page 4-96). A screening level risk assessment was performed for the shrew, not a baseline risk assessment that uses site-specific dietary data. Because earthworms were not collected, there is high degree of uncertainty with associated risk estimates. More accurate risk estimates to small mammals such as shrews are desirable because shrews can be found in areas similar to those frequented by pets that roam into the drier wetland areas. In addition, Figure 4-37, Comparison of Arsenic in Sediment to Ecological Thresholds, shows that 7 areas/locations in Reach 2 exceed the shrew threshold and muskrat threshold."

EPA Response: The risk assessments acknowledge and evaluated the uncertainty associated with the risk estimates for shrew. The use of soil-to-earthworm bioconcentration factors represents a conservative estimate of risk.

D. 20. The ASC's consultant commented that: "because benchmarks are not available for some chemicals of concern and because the ecological effects of exceeding the benchmarks are not well defined, another measurement endpoint should be used to evaluate the potential effect of chemicals on the fish populations in the Aberjona River and Mystic Lake. This endpoint should be an assessment of the fish community to evaluate the biological integrity of the Aberjona River.

One such endpoint could be the Index of Biotic Integrity, which is an aggregation of 12 biological metrics that are based on the fish community's taxonomic and trophic composition and the abundance and condition of fish. These metrics assess the species richness component of diversity and the health of resident taxonomic groupings and habitat guilds of fish. Two of the metrics assess the community composition in terms of tolerant or intolerant species. Fish protocols are described in U.S. EPA (1999). [Note: Reference provided in ASC's Reference section: *1999 Update of Ambient Water Quality Criteria for Ammonia*. Office of Water. Office of Science and Technology. Washington, DC. December 1999. EPA-822-R-99-014]

EPA's conclusion (Page 4-98) that 'the assessment did not indicate any impacts on the local populations of predatory fish, bottom feeding fish, and small foraging fish populations' is flawed.

The evaluation does not directly address the ecological effects of COPCs but merely compares tissue concentration to tissue residue benchmarks. An evaluation of the age structure of a fish population for each of the different feeding classes would be indicated if existing fish populations have been affected."

EPA Response: Following EPA guidance, an assessment endpoint was established for assessing fish populations. The measurement endpoint associated with the assessment endpoint was the comparison of fish tissue concentrations to tissue residue benchmarks, as an indication of potential population effects. Based on this endpoint there was no evidence of ecological effects in the Southern Study Area. Fish community studies were conducted by U.S. Fish and Wildlife Service in the Northern Study Area. The population data from the Northern Study Area indicated impairment of fisheries; however, the relative influence of poor quality habitat conditions could not be distinguished from impacts associated with toxicity from contaminants. EPA's goal was to focus data collection on areas, pathways, and receptors that represented highest exposures. Although the fish data from Reach 0 indicated elevated exposures to arsenic, tissue residue and community data did not document significant community impairment in Reach 0. Due to habitat conditions, fish sampling in the upper reaches of the Southern Study Area did not result in sufficient sample sizes to conduct population studies. However, if no significant effects on fish populations were able to be documented in Reach 0, the potential for risk in downstream habitats with lower exposures is unlikely to be significant.

D. 21. ASC's consultant commented that the drinking water ingestion pathway should be explicitly considered in the human health risk assessment.

EPA Response: The groundwater evaluation of the Northern Study Area (from (including) Industri-plex OU-1 to Interstate 95) is based on the Groundwater Use and Value Determination, prepared by MassDEP. The groundwater determination classifies groundwater in this aquifer of "low" use and value, and specifically identifies exposure pathways of relevance to be included in the risk assessment. The groundwater determination further specifies the requirement that MCLs must be met before groundwater enters the Interim Wellhead Protection Area to the south of the Northern Study Area. The risk assessment for the Northern Study Area is consistent with the MassDEP Groundwater Use and Value Determination and, therefore, does not include a residential drinking water scenario. In the March 2005 RI and June 2005 FS, EPA identifies groundwater plumes originating from Industri-plex OU-1 and discharging into the HBHA. The Remedial Investigation did not show that groundwater plumes migrate downstream and impact the Wells G&H site. However, EPA did identify and evaluated the potential concern that sediments deposited in the Wells G&H wetland could release dissolved forms of metals contamination (e.g. arsenic) into the aquifer and impact the future supply wells within the Wells G&H site aquifer. EPA prepared a January 2005 Technical Memorandum (Appendix 5A in the March 2005 MSGRP RI) which concluded this was unlikely. Note that under the Wells G&H Superfund Site Operable Unit 2, additional data will be collected from the Wells G&H aquifer and any remaining site-relate aquifer issues will be addressed under that operable unit. The conclusions of the January 2005 Technical Memorandum will be reviewed as new information gathered as part of the Wells G&H OU-2 investigation data becomes available.

D. 22. The ASC's consultant commented that: "MSGRP pg. 6-10 ascribes considerable uncertainties associated with some exposure point concentrations that are influenced by highly variable data. The precise purpose of using an upper confidence limit on the mean is to account for such uncertainty, which typically results from insufficient numbers of samples to characterize the data distribution. Default risk assessment techniques substitute the maximum detected concentrations within reasonable maximum exposure calculations in cases in which upper confidence limits exceed the maximum values. In these situations, EPA should conduct sensitivity calculations on the risk estimates based on the upper confidence limits (even though they would be higher than the maximum concentrations). If the risk estimates of the sensitivity estimates exceed risk management criteria, EPA should consider further sampling in these areas to better characterize exposure point concentrations and reduce uncertainties.

Additionally, examples of singularly high concentrations such as the 1,600 mg/kg detected at location SC02 suggest the presence of "hot spots" that, if contacted even on occasion, might present excessive risks to human health. EPA should evaluate the potential need for the evaluation of health risks due to acute or short-term exposures. The ATSDR has established an acute Minimum Risk Level (MRL) of 0.005 mg/kg-d for arsenic. A 70 kg dredger ingesting an elevated level of 500 mg/kg per day of soil with an arsenic concentration of 1,600 mg/kg would receive a daily dose of 0.01 mg/kg-d, a value twice the acute MRL. EPA should evaluate acute exposure levels of potential concerns and consider the need for appropriate measures to protect individuals (such as dredgers) against short-term hazards.

> The car wash scenario is likely a conservative estimate of the degree of exposure that a worker might receive from exposure to volatile chemicals emanating from groundwater used as industrial process water. As noted on p. 6-10 of the MSGRP, other groundwater use scenarios might be associated with much lower risk. As constructed, the risk assessment provides only the car wash scenario as a basis for developing potential restrictions on groundwater use. We suggest that additional scenarios be added to the risk assessment to provide a broader basis for determining guidelines for using groundwater for industrial or commercial (or other non-contact) uses."

EPA Response: The areas with uncertain exposure point concentrations (SC02 and SO-13) influenced by highly variable data have been identified as requiring action as part of this remedy. EPA agrees that further sampling in these areas is necessary. Therefore, a pre-design investigation will be conducted to more closely delineate the extent of contamination exceeding the sediment cleanup standards and requiring action. Because there are no current exposures occurring to sediment core location SC02, an evaluation of the acute effects of arsenic at this location is not necessary. Note that exposures at this location will be controlled in the future through institutional controls, ensuring that future dredging workers implement appropriate health and safety measures to protect themselves from both acute and long-term health affects associated with arsenic. Regarding groundwater use scenarios, the remedy will also restrict groundwater usage at the Northern Study Area. The risk assessment evaluated groundwater exposures related to a car wash worker, an industrial worker exposed to process water, and an on-site construction worker. EPA considers the groundwater exposure pathways to be reasonable, appropriate and protective.

> D. 23. The ASC's consultant commented that: "[a]lthough current exposure to buried sediment from the former Mishawum Lake bottom is unlikely, it is necessary to consider future use of these areas. EPA appropriately sampled these soils and included the data in the risk assessment."

EPA Response: Comment noted.

> D. 24. The ASC's consultant commented that ammonia should be considered as a contaminant of concern in the ecological risk assessment.

EPA Response: EPA agrees that ammonia was detected at high concentrations in groundwater and surface water, and should be a contaminant of concern. The March 2005 MSGRP RI presents a detailed discussion of all groundwater sampling events conducted at the site and identifies high concentrations of ammonia within the contaminated groundwater plumes. The highest concentrations in groundwater (up to 2,710 mg/L) are observed at sample locations adjacent to or downgradient of the hide piles or where animal waste have been buried, such as the NSTAR right-of-way.
EPA's June 2005 Administrative Record contains a report (cited by the commenter) entitled "Ammonia Data For Water Quality Samples," dated June 24, 2005, authored by Robert Ford (EPA), which includes groundwater and surface water data. The data identify high concentrations of groundwater discharging into the northern portion of the HBHA Pond up to 2349.7 mg/L, and high ammonia concentrations in deeper portions of the HBHA Pond up to

1762.2 mg/L. The concentration of ammonia in shallow surface water of the HBHA Pond outlet is elevated, ranging from 4.0 mg/L to 17.9 mg/L.

The Industri-plex OU-1 has a very large source of organic nitrogen in the form of buried animal hide wastes. As bacteria decompose the waste, some of the nitrogen that was bound up in complex organic molecules is released to the soil as ammonia. Through leaching processes, the ammonia is converted to ammonium by reacting with water. The fate and transport of ammonia contamination in groundwater is consistent with the contaminated groundwater plumes fate and transport presented in the MSGRP RI, where the contaminated groundwater plumes discharge into the HBHA Pond and impacts aquatic life. The presence of the chemocline serves to sequester the highest concentrations of ammonia at depth while assisting in the processes that decrease ammonia concentrations in the more oxic zones of the water column. EPA's selected remedy will adequately address the ammonia concentrations.

EPA has prepared the October 2005 Technical Memorandum – Evaluation of Ammonia and Supplemental Soil Data and October 2005 Fact Sheet supplementing the June 2005 Proposed Plan, which further presents, assesses and explains ammonia's impact on groundwater and surface water. Cleanup goals for the protection of human health and the environment have been developed for groundwater and surface water, respectively, and are presented in the October 2005 Technical Memorandum. This October 2005 Technical Memorandum was included in the Administrative Record for this Record of Decision and was available for review and comment during the reopened public comment period from October 20, 2005 to November 18, 2005. The selected remedy will identify ammonia as a contaminant of concern, and comply with National Recommended Water Quality Criteria (NRWQC).

D. 25. The ASC's consultant commented that there is still too much uncertainty in the shrew calculations.

EPA Response: The risk assessments acknowledge and evaluate the uncertainty associated with the risk estimates for shrew. The use of soil-to-earthworm bioconcentration factors represents a conservative estimate of risk. The selected remedy includes strategies to reduce transport and further deposition of COPCs, including arsenic, from upstream sources.

D. 26. The ASC's consultant commented that: "[w]e disagree with the statement on Page 7-4, 'The resulting level of ecological risk for the receptors is low except for the benthic invertebrates in the HBHA Pond.' Arsenic frequently is detected above reference criteria in areas other than the HBHA Pond.

EPA Response: It is clearly documented in the BERA that arsenic concentrations exceeding reference concentrations are found outside of HBHA Pond, however, the presence of arsenic in the sediment did not correspond to significant ecological effects. This has been attributed largely to the variation in the bioavailability of arsenic, depending on sediment chemistry and other factors.

D. 27. The ASC's consultant commented that: "because no population measurements were taken, one could state that the risk assessment does not provide sufficient evidence to conclude that arsenic contamination in the study areas *is not causing* an adverse effect on muskrat populations. The density of individual muskrats in the HBHA wetlands and 38-acre wetland was not measured. This measurement would be beneficial to estimate the frequency of muskrat use as well as the habitat value to the muskrat. In addition, if individual muskrats were captured, their fur could be analyzed for arsenic to determine if exposure to arsenic had occurred."

EPA Response: Conducting population studies, with the associated high uncertainty, would not likely provide conclusive evidence to show significant effects on muskrat population as compared to reference areas. The baseline ecological risk assessment's level of analysis conducted for the evaluation of potential effects on muskrat was adequate, and based on these data, the risk assessment does not provide sufficient evidence to conclude that arsenic contamination in the study areas is causing a significant adverse effect on muskrat populations. EPA has acknowledged the uncertainty in the risk evaluation. In addition, unless there are TRVs in the literature relating arsenic concentrations in mammalian fur to effects on reproduction, growth, or mortality, collecting these types of data would not assist in determining effects, only in assessing exposure.

D. 28. A resident of Wilmington commented that in some instances, the human health risk assessments were based only on food and did not include the breathing, drinking water, and skin absorption of receptors to contamination sources.

EPA Response: All human health exposure scenarios were developed appropriately for this site in accordance with EPA risk assessment guidelines. All appropriate exposure pathways were evaluated in the quantitative evaluation including skin absorption and inhalation exposures. The drinking water pathway was not included because groundwater within the Northern Study Area (north of Interstate 95) is not considered a drinking water source area by MassDEP (see MassDEP's Use and Value Determination for the Industri-plex study area)..

D. 29. A resident of Wilmington commented that wildlife is dead and yet EPA found no link to the contamination.

EPA Response: The baseline ecological risk assessment was conducted in accordance with EPA risk assessment guidelines. Unacceptable ecological risks related to the site were only identified in the HBHA Pond. EPA studies did not show unacceptable risk to wildlife for site contaminants in other areas.

D. 30. A resident of Wilmington commented that complete hydrocarbons should be evaluated as part of the risk assessment. She further commented that the use of metals as risk assessment markers is not appropriate nor based upon currently available technology.

EPA Response: EPA disagrees with the comment suggesting that the risk assessments were incomplete or only evaluated certain "marker" contaminants or incomplete exposure pathways. The baseline risk assessments were prepared in accordance with EPA risk assessment guidelines and accepted technology. Sampling was conducted for the full suite of contaminants including volatile and semi-volatile organic compounds, pesticides, polychlorinated biphenyls, metals and water quality parameters. All contaminants detected were evaluated in the risk assessments.

D. 31. SMC, Pharmacia and the consultant retained by SMC and Pharmacia and SMC comment that the sediment ingestion scenarios relied upon by EPA in determining a current human health risk in two locations are not credible, as the locations are difficult to access.

EPA Response: The exposure scenarios are reasonable and appropriate, consistent with EPA risk assessment guidance, factor in future land use considerations, and are health-protective. In addition, these exposure scenarios are supported by the MassDEP. Only samples determined to be reasonably accessible, based on field observations, were applied to the human health risk assessment. Samples located in areas overgrown with reeds, vines, brambles or with excessively soft sediments, and considered inaccessible, were not quantitatively evaluated for human exposures. The Cranberry Bog and Wells G&H wetland are well utilized areas by the neighborhood and community. Future plans by the City of Woburn include development of the Wells G&H wetland into a passive recreational area. The Cranberry Bog is surrounded by residences, making it plausible that young children living in these residences may contact sediments and soils in areas adjacent to their yards. EPA visited each of the sediment exposure areas on a number of occasions. During each of these visits, adults and children were observed utilizing these areas (e.g., walking dogs, playing in groups, sliding down the embankments). Therefore, it is reasonable and health-protective to consider that residential children and adults living immediately adjacent to the former cranberry bog may come into direct contact with contaminants in sediment at an exposure frequency of 104 days/year. This exposure frequency approaches that used to evaluated a residential scenario (150 days/year) but also considers that each of the visits may not result in direct contact with sediments. Future plans by the City of Woburn include development of the Wells G&H wetland into a passive recreational area. The 78 day/year-exposure frequency for the Wells G&H wetland area is for future exposures. It is likely that children and adults would visit this area more frequently than 78 days per year. In fact, residents have stated to EPA that they currently go to this area nearly every day. The 78 days/year exposure frequency is intended to provide a reasonable maximum estimate of the number of days of sediment and surface water contact per year for future site use in the Wells G&H wetland area. The total number of visits per year, which may include visits without sediment and surface water contact, is acknowledged as likely to exceed 78 days per year.

Note: Because responses to the October 13, 2003 comments provided by Gradient Corporation (consultant for SMC) on the Aberjona River Study were prepared by EPA and are contained as part of the Administrative Record for the Site, no additional responses to the resubmitted October 13, 2003 Gradient comments attached to this August 29, 2005 comment letter have been provided.

D. 32. The consultant retained by Pharmacia and SMC commented that because the proposed nature trail in the Wells G & H wetland is located in the upland area and does not extend in the wetland where the contaminated sediments are located, the exposure pathway should be considered incomplete.

EPA Response: EPA considers the areas accessible and determined that unacceptable human health risks exist at the areas. The construction of the nature trail in the upland area near station WH would attract recreational users to the Wells G&H 38-acre wetland and be an invitation for those visitors to explore the passive recreational space. Recreational visitors would not be restricted or limited in their ability to explore the area beyond the nature trail, including the near shore wetland areas. Therefore, the presence of the nature trail would potentially increase the frequency with which a recreational visitor may access near shore sediment at station WH. The evaluation of this potential future sediment exposure pathway using exposure assumptions inappropriate for a reasonable maximum exposure scenario would not be health-protective or consistent with EPA risk assessment guidance.

> D. 33. Pharmacia and SMC and the consultant retained by Pharmacia and SMC commented that the MSGRP Human Health Risk Assessment was not conducted consistent with EPA guidelines and used unrealistic exposure scenarios and overly conservative exposure parameters.

EPA Response: The MSGRP RI baseline risk assessment was prepared consistent with EPA risk assessment guidance and the Wells G&H OU-3 Aberjona River Study HHRA, and to conform to the requirements of the Final GSIP work plan, prepared by the Industri-plex PRPs and commented on by EPA and MassDEP. Note that the Aberjona River Study HHRA, upon which the MSGRP HHRA was based, was reviewed and commented on by the PRPs, the public, and the MassDEP, and was revised to address those comments and to be transparent, clear, consistent, and reasonable, given the many diverse opinions on where the "zone of reasonableness" might lie.

Furthermore, as prescribed by EPA guidance, both HHRAs were prepared to evaluate a reasonable maximum exposure (RME) case which is a combination of upper-bound variables and average variables either recommended by EPA or assumed based on site-specific information, as available. As defined by EPA, the RME case should use a combination of variables, some at the maximum (95th percentile) and others are the average (50th percentile). Specifically, RAGS Part A recommends a 95% UCL for the EPC, 95th percentile values for contact rates (e.g., a soil ingestion rate), 90th or 95th percentile values for exposure frequency and exposure duration variables, and average (50th percentile) values for body weights. This EPA recommended approach of combining upper bound with average variables was used in the preparation of the risk assessment. The selected exposure variables used in the risk assessment were values recommended in EPA guidance documents or based on site-specific information, as available. The RME exposure estimates were combined with EPA-recommended toxicity information to estimate RME cancer risks and non-cancer hazards. The sources of these values were clearly explained and documented in the report, leading to a transparent and clear evaluation. The use of EPA-recommended exposure and toxicity values to the maximum extent possible results in estimated risks and hazards with a consistent basis across this Site and a basis that is comparable to other regional sites, exclusive of site-specific information.

The risk assessment was also prepared to account for future potential exposure pathways, as required by EPA guidance, since those hypothetical future exposure pathways may not be completely controllable. Until institutional controls are fully implemented at the Site, those future pathways are considered potentially complete, and knowledge of the potential risk findings associated with those pathways are important to the risk management process. Additional detail on each of these general topic comments is provided below under responses to specific comments.

> D. 34. The consultant retained by Pharmacia and SMC commented that a tiered approach to risk assessment should have been used.

EPA Response: A sequence of steps was used in performing the MSGRP and Aberjona River Study risk assessments. Screening level evaluations were performed on the initial rounds of data collected (e.g., 1995/1997 and 1999 rounds). The initial screening of these samples, many collected in inaccessible areas, indicated that additional data were required to adequately evaluate potential human health risks and hazards in accessible areas. In 2001 - 2002, additional data in upland and near-shore areas were collected in support of the HHRAs. Following the collection of these data and a second screening-level evaluation, the arsenic bioavailability study was performed to more accurately characterize the human health risks and hazards associated with elevated arsenic levels in accessible sediments. This study represents a significant step in the reasonable evaluation of arsenic hazard and risk at this Site.

Following release of the draft Aberjona River Study HHRA, comments on the report indicated the need to conduct additional sampling in upland areas potentially impacted by flooding and to evaluate dredging within the watershed based on a specific scenario being considered for flood abatement. After the gathering of site-specific information for current exposure scenarios (e.g., flooding frequency, dredging project duration) and the selection of exposure assumptions to characterize future RME scenarios according to EPA guidance, the reports were prepared in final draft form. The process used to prepare the final draft reports fulfills the intent of the Tiered Approach by incorporating site-specific information for exposure pathways, as appropriate, and after identifying the primary risk-contributing chemical (i.e., arsenic), developing an approach to estimate the risk and hazard associated with this analyte using site-specific information.

The result is a risk assessment where the conclusions are based on contaminant distributions appropriately identified by multiple rounds of sampling, state-of-the-art scientific methods, and reasonable, yet health-protective, exposure assumptions.

> D. 35. The consultant retained by Pharmacia and SMC commented that "the use of multiple upper bound assumptions . . . substantially overestimates the "average" level and even the reasonable maximum level of potential risk. Having used the 95% upper bound (or sometimes the maximum) environmental medium concentration as the exposure point concentration (EPC) for all of the risk calculations and having used the USEPA derived toxicity values, which are all upper-bound conservative values, means that all the risk results, regardless of whether the other exposure parameters are averages or upper bounds, will result in exceeding the level of protectiveness sought under USEPA guidance."

EPA Response: The risk assessment was prepared using EPA guidance relative to the evaluation of reasonable maximum exposure (RME) risk and hazards estimates. As defined by EPA and stated above, the RME scenario should use a combination of variables, some at the maximum (95th percentile) and others are the average (50th percentile). This EPA recommended approach of combining upper bound variable with average variables was used in the preparation of the risk assessment. Exposure variables used in the risk assessment were recommended by EPA or based on site-specific information, as available. The RME exposure estimates were combined with EPA-recommended toxicity information to estimate RME cancer risks and non-cancer hazards. The resulting evaluation is reasonable, yet health-protective.

> D. 36. The consultant retained by Pharmacia and SMC commented that "it is entirely unlikely and unreasonable to assume that well water would be used for any purpose with in the Industri-Plex Site and the MSGRP study area. Therefore, the future groundwater use scenarios (industrial worker process water use and car wash worker) should not be included in the MSGRP HHRA as exposure to groundwater used for industrial or commercial purposes is not a complete exposure pathway."

EPA Response: The risk assessment included an evaluation of potential future non-potable groundwater uses that are not currently restricted by any regulation. The risk assessment scenarios are consistent with the Groundwater Use and Value Determination for the Industri-plex aquifer within the Northern Study Area prepared by MassDEP. In addition, their inclusion complies with the EPA mandate to evaluate potential future land use scenarios.

> D. 37. The consultant retained by Pharmacia and SMC commented that the "use of groundwater in a car wash scenario should not have been included in the risk assessment as a complete exposure pathway based on City of Woburn zoning and groundwater use restrictions. However, even if it was included, it should only have been applied to the B-I zoning areas, and only using data from wells located in these areas, not using the summarized data for the Site and study area as a whole. If this had been done, risks for this receptor would be zero in the B-I #1 area (as no constituents were detected) and would not have exceeded the regulatory guidelines in the B-I #2 area. Moreover, if the shower model had been correctly applied to the data, whether in the B-I areas or erroneously for site-wide groundwater, it is likely that no regulatory guidelines would have been exceeded."

EPA Response: The zoning classifications represent current land use and do not represent future land use, which is considered in the risk assessments. Because zoning laws and classifications may be changed, the future car wash scenario was included based on the "low" use and value determination for the entire Industri-plex aquifer within the Northern Study Area. Portions of this aquifer were identified as not being associated with risk and/or hazard above risk management guidelines for this scenario. The car wash scenario was chosen to represent a conservative non-potable groundwater use scenario focused on the inhalation of volatile compounds. A 95th percentile exposure duration (25 years) was used as recommended by EPA guidance for the RME scenario. Since most car washes do not have a separate enclosed area for workers which may limit worker exposures to impacted air, the typical length of a work day (8 hours) was used for the exposure time. Because car wash facilities vary in size and the types of equipment used, the modeled car wash was assumed to be proportionately similar to a shower. This approach acknowledges that a car wash uses a larger volume of water than a shower, but the car wash also allows the volatile compounds to distribute into a proportionately larger space. A higher degree of ventilation was not factored into the modeling because there is no requirement that a car wash will be constructed with a specific dryer, if any. This approach and assumptions are reasonable and allowed for the use of an EPA-approved model to generate volatile compound airborne concentrations during water usage.

> D. 38. The consultant retained by Pharmacia and SMC commented that if the groundwater as industrial process water scenario is included in the MSGRP HHRA, the ingestion pathway should be designated as incomplete.

EPA Response: The process water scenario was chosen to capture a conservative non-potable groundwater use scenario which included all three exposure pathways (incidental ingestion, dermal contact, and inhalation) and to comply with the EPA requirement to evaluate potential future use scenarios. This scenario assumes that an individual would dermally contact extracted groundwater for one hour of the workday. Gloves, long sleeves, or other impediments to dermal contact were assumed to be in place for the remainder of the day. The water ingestion rate of 50 mL/day (approximately one mouthful over the course of a typical work day) accounts for the accidental splashing of water into the mouth. It can not be assumed that workers would be health and safety trained or even be aware that the process water in use may be contaminated.

> D. 39. The consultant retained by Pharmacia and SMC commented that ingestion of shallow groundwater during excavation activities should not be identified as a complete exposure pathway, and no risks or hazards should be calculated for this pathway; this commenter further stated that dermal contact with groundwater during excavation did not result in risks above regulatory guidelines.

EPA Response: The groundwater ingestion rate of 50 mL/day (approximately one mouthful over the course of a typical work day) was used to account for the accidental splashing of water into the mouth during excavation activities. This value is within the range of reasonable professional judgment values used to evaluate this pathway.

> D. 40. The consultant retained by Pharmacia and SMC commented that "[u]se of the relative bioavailability (RBA) for soils would result in an almost 2-fold decrease in risks calculated for ingestion of arsenic in soils pathway – ingestion of arsenic in soils is the risk-driver for both the construction worker and day care child scenarios."

EPA Response: The site-specific arsenic bioavailability study was performed specifically for depositional sediments, not soil. Because the soil matrix composition and structure could differ considerably from that of sediment, the arsenic bioavailability estimate was not considered applicable to the soil ingestion pathway. However, during pre-design, additional site-specific, EPA-approved studies/tests may be conducted to determine the relative bioavailability of arsenic from surface soils, or from subsurface soils, if such an approach is deemed beneficial in limiting the extent of institutional controls that may be necessary for individual properties. EPA-approved studies/tests include in-vivo bioavailability studies (e.g. swine bioavailability study) similar to the study conducted by EPA during the MSGRP RI. Future EPA-approved studies may potentially include in-vitro bioavailability studies (not currently approved by EPA).

Individual studies must be conducted for surface soils and subsurface soils (samples from both samples may not be consolidated into one sample because of likely variability in the soil matrix).

D. 41. The consultant retained by Pharmacia and SMC commented that if EPA used the upper-bound soil ingestion rate of 100 mg/day for the construction worker, the site-specific sediment arsenic bioavailability factor for soil ingestion, and eliminated the shallow groundwater ingestion pathway, the resulting potentially carcinogenic risks would not exceed the regulatory guidelines for the construction worker, and the hazard index would be only slightly above the regulatory guideline of 1 for the SO (former Mishawum Lake and associated wetlands) subsurface soil exposure area, and would be below the regulatory guideline for the SO surface soil exposure area.

EPA Response: Exposure assumptions used for the construction worker scenario were obtained from the most current EPA guidance sources available. The evaluation of two distinct exposure intervals is consistent with EPA Region I guidance and prevents the dilution of an exposure point concentration for one interval containing higher levels of contaminants through the addition of data points from a different interval which contains lower contaminant concentrations. This mathematical dilution of an exposure point concentration might result in the lack of identification of a soil interval requiring action. Conversely, the evaluation of each interval as a distinct exposure interval prevents the possible false conclusion that both intervals require action to the same degree. The sediment arsenic bioavailability study is not applicable to soils and EPA does not believe that a 100 mg/kg soil ingestion rate is health-protective for a construction worker.

D. 42. The consultant retained by Pharmacia and SMC commented that "use of more realistic, yet still conservative exposure factors results in PRGs for arsenic in soil for the day care child scenario that are higher than the USEPA-derived values."

EPA Response: The day care scenario was chosen to evaluate potential day care exposures. Note that children not only attend day care during their preschool years, but also after their preschool years for before-school and after-school care, and also during school vacation periods. The first six years of life were selected for evaluation to account for this continuous period of care until a child goes to preschool, but also to account for the additional time a child may attend a day care facility after the preschool years. The exposure frequency (150 days/year relative to a possible 250 days/year of day care) accounts for adverse temperature and weather conditions during periods of the year within the New England area. As prescribed for the RME scenario, the 95th percentile value for soil ingestion, 50th percentile surface areas, and a dermal adherence factor for a reasonable upper-bound activity were used. The 95% UCL was used as the exposure point concentration, as recommended by EPA guidance for the RME scenario. The sediment arsenic bioavailability study is not applicable to soils. EPA does not believe that the exposure assumptions recommended in this comment are health-protective for a day care scenario.

D. 43. The consultant retained by Pharmacia and SMC commented that "[i]t is likely that if the more realistic exposure assumptions and EPCs are used in the MSGRP HHRA, risks for this hypothetical future dredger receptor would not exceed regulatory guidelines."

EPA Response: The exposure frequency and exposure duration for the dredging worker is based on site-specific information obtained for a flood-control project being contemplated for the watershed. Other exposure assumptions used for the dredging worker scenario were obtained from the most current EPA sources available for excavation workers.

D. 44. The consultant retained by Pharmacia and SMC commented that "based on [their] review of the available scientific data [for arsenic] (including numerous studies that have been published since the RfD was last revised), use of a diet -adjusted NOAEL of 0.0024 mg/kg-day (reflecting a NOAEL of 0.0015 mg/kg-day and a dietary intake of 0.0009 mg/kg-day) together with an MOE of 1 represents a conservative (i.e., health-protective) toxicity benchmark (RfD = 0.0024 mg/kg-day) for assessing potential non-cancer health risks associated with long-term exposures. This RfD is 8-fold higher that that developed by USEPA. Use of this value would result in an 8-fold decrease in the calculated hazards in the MSGRP and would result in an 8-fold increase in the noncancer-based PRGs."

EPA Response: The baseline risk assessments were prepared in accordance with EPA guidance documents. The current EPA-recommended oral reference dose for arsenic was used in the evaluation. The data upon which this toxicity value is based has been extensively reviewed within the scientific community and the recommended value represents the most defensible estimate of the noncarcinogenic toxicity of this compound.

D. 45. The consultant retained by Pharmacia and SMC commented that "[t]he uncertainties and high degree of conservatism in the cancer potency estimates [for arsenic] provide an additional reason why the MSGRP HHRA should have been refined with more realistic exposure assumptions prior to using it as the basis for remedy decisions."

EPA Response: The baseline risk assessments were prepared in accordance with EPA guidance documents with exposure assumptions which EPA considers reasonable, as explained above. The current EPA-recommended oral slope factor for arsenic was used in the evaluation. The data upon which this toxicity value is based has been extensively reviewed within the scientific community and the recommended value represents the most defensible estimate of the carcinogenic potency of this compound.

D. 46. The consultant retained by Pharmacia and SMC commented that "[b]ecause the Anttila et al. [TCE carcinogenicity] values represent a more scientifically defensible starting point for characterizing TCE's carcinogenic potency, the MSGRP HHRA overstates the risks from ingestion of TCE in groundwater and inhalation of TCE in indoor air, notwithstanding that neither of these exposure pathways should be identified as complete within the study area."

EPA Response: The baseline risk assessments were prepared in accordance with EPA guidance documents. The carcinogenic potency of trichloroethylene is currently under review by EPA. Once the review is completed and revised potency estimates are released, the impact of the potential changes will be reviewed as part of the five-year review process.

D. 47. The consultant retained by Pharmacia and SMC commented that "t]he result of using the most conservative toxicity value for benzene is to overstate the risks from exposure to benzene."

EPA Response: The high-end of the range of values provided for benzene was used in the quantitative evaluation. To account for the conservative selection of benzene cancer toxicity values, a 10^{-5} cancer risk was selected as the target risk level for PRG calculation. Therefore, this uncertainty has been adequately addressed and accounted for by the selection of a target cancer risk level one order of magnitude higher than the recommended point of departure (i.e., 10^{-6}).

D. 48. The consultant retained by Pharmacia and SMC commented that EPA "did not take the limited benthic invertebrate habitat of HBHA Pond into account in their analysis. Even under the best of conditions, HBHA Pond is a stormwater retention basin and not a quality ecological habitat. Remediation to be conducted under USEPA's -Proposed Plan will not improve the quality of the benthic invertebrate habitat in HBHA Pond."

The consultant retained by Pharmacia and SMC commented that no remedial action was recommended for sediment below the thermocline at a similar pond at the W.R. Grace Site in Acton, Massachusetts.

Pharmacia added that because of anoxic conditions, the benthic invertebrate community in the hypolimnion of stratified lakes and ponds such as the HBHA Pond is typically impoverished and, in persistent anoxic conditions, can be completely absent.

EPA Response: EPA has made a site-specific determination based upon the data, fate and transport, and risk assessment results at the Industri-plex OU-2, including Wells G&H OU-3.

The conditions, risk evaluations, and cleanup decisions associated with the HBHA Pond are site specific and not applicable to the W.R. Grace Superfund Site, Acton, MA. It is the policy of EPA to determine cleanup goals on a site-specific basis. It is also essential to do so with respect to the HBHA Pond and Sinking Pond because these systems are entirely different in their habitats, sources of contamination, and fate and transport of contaminants.

The HBHA Pond is less than 20 feet deep and continuously receives contaminated groundwater plumes discharges in deeper portions of the pond. The HBHA Pond also receives surface water discharges at the surface of the pond. These discharges produce the chemocline within the HBHA Pond which helps keep the highest concentrations of contamination in surface water below the chemocline. This chemocline is an unnatural condition within the HBHA Pond. The sediments in the HBHA Pond contain high concentrations of contaminants and are severely toxic (i.e., associated with significant mortality). The surface water in the HBHA Pond contains high concentrations of contaminants and exceed NRWQC. The HBHA Pond contains various fish species and benthic invertebrates, and these fish and invertebrates contain elevated levels of contaminants in their tissues. EPA considered all the data and the uniqueness associated with the

HBHA Pond, and determined that surface water and sediment in the HBHA Pond posed an unacceptable ecological risk.

Sinking Pond at the WR Grace Site, Acton, MA, is a kettle pond approximately 45 feet deep with no surface water outlet. The primary source of contamination at Sinking Pond is attributed to the surface water discharge directly to the pond from a groundwater treatment system. Also, the hypolimnion present at the Sinking Pond is associated with the kettle pond's natural conditions, while the chemocline at the HBHA Pond is associated with contaminated groundwater plumes discharge and unnatural conditions. Only one sample in the sediments from the deep water of Sinking Pond showed any effect in toxicity testing, and the effect was marginal in significance.

The severe toxicity (i.e., significant mortality) of the sediments in the laboratory at all locations tested in HBHA Pond clearly indicates toxicity of the sediments, independent of other habitat conditions. The toxicity observed in the laboratory was not related to anoxic conditions, since the overlying water in the laboratory was aerated.

The toxicity testing results and tissue concentrations of fish and invertebrates differentiate the benthic invertebrate results in HBHA Pond from the pond reference (Phillips Pond – which also exhibited low oxygen in deep water during stratification) and downstream locations. In addition, the surface water concentrations exceed NRWQC and contribute to aquatic life impacts. EPA determined the surface water and sediments in the HBHA Pond pose an unacceptable ecological risk and warrant action.

EPA believes that remediation of sediments in the southern portion of HBHA Pond will improve and provide additional habitat for aquatic life (e.g., benthic community and fish). The remediation of the southern portion of the HBHA Pond will also reduce downstream migration of contamination.

> D. 49. The consultant retained by Pharmacia and SMC commented that EPA "arbitrarily selected a Preliminary Remediation Goal (PRG) for the protection of benthic invertebrates from a limited amount of data. In selecting the PRG of 273 mg/kg for arsenic in HBHA sediments, USEPA ignored data showing no effects on benthic invertebrates at arsenic concentrations over 1,000 mg/kg. They also ignored their own analyses showing that effects on benthic invertebrates were more highly correlated to habitat conditions (dissolved oxygen concentration, acid volatile sulfide concentrations, water depth, and flow) than sediment arsenic concentrations."
>
> Pharmacia reiterated this comment in a separate submission.
>
> The Pharmacia and SMC's consultant also commented that ".... body burdens of arsenic in benthic invertebrates were similar in the deep water stations in HBHA Pond and downstream in the wetlands. This supports the analyses that demonstrate the toxicity to benthic invertebrates in deep water Pond locations is due to causes other than arsenic."

EPA Response: EPA evaluated all the relevant data and stands behind its nature and extent, fate and transport, and risk evaluations. While not recognized in the comment, fate and transport processes of the groundwater plumes, including but not limited to high arsenic, benzene, ammonia, conductivity, reducing conditions and low DO, and migration and discharge into the HBHA Pond, have contributed to contamination and risks in the HBHA Pond, as well as downstream areas.

EPA utilized data reported in the BERA, as appropriate, when developing site cleanup goals. For data collected outside of the HBHA Pond, the greatest correlations were found between benthic community and habitat quality measurements (acid volatile sulfide concentration in the sediment, water depth, dissolved oxygen content of the overlying water, flow regime, and total organic carbon (TOC)). The data within the HBHA Pond differed dramatically from the rest of the community data observed outside the pond, highlighting the uniqueness of the HBHA Pond. This uniqueness relates to the fact that the HBHA Pond receives a continuous source of contaminated groundwater in the deeper portions of the pond, surface water discharges at the surface of the pond, the presence of the chemocline which helps keep high concentrations of contaminants in surface water below the chemocline, high concentrations of contaminated surface water above NRWQC in the HBHA Pond, high concentrations of contaminated sediments in the HBHA Pond, sediments with extreme toxicity (e.g., significant mortality) in the HBHA Pond, fish and benthic communities presence in the HBHA Pond, fish and benthic communities tissues from the HBHA Pond containing elevated levels of contamination (e.g. arsenic), etc. EPA considered all the data and determined that the surface water and sediment in the HBHA Pond pose an unacceptable ecological risk.

With regard to arsenic in HBHA Pond benthic invertebrates, Appendix Table 7B.6.1 summarizes benthic invertebrate tissue data. Benthic invertebrate tissue data exist for SED-07, 2.3 mg/kg arsenic. There are no tissue data for SED-05, because no organisms were collected. Although an indication of elevated arsenic in tissue, this value from SED-07 has some uncertainty, since it is based on a limited sample size and is not replicated at another deep location. As indicated in the comment, this value is lower than tissue samples collected outside of the HBHA Pond. This could be a result of a number of factors, including that the sample may represent an early instar which did not have a very long exposure to the sediment before it was collected. Contrary to what is stated in the comment, this single value does not prove that arsenic does not contribute to the toxicity observed in the sediments from deep water in HBHA Pond. The highest invertebrate tissue concentration was measured at location MC-06 in the shallow sediments of HBHA Pond of 26 mg/kg.

Based on the analyses in the BERA, EPA concluded the benthic invertebrate data outside of the HBHA Pond indicated a low level of effects on community composition and toxicity correlated to arsenic (even accounting for all of the other environmental variables mentioned above). EPA also concluded these effects were not severe enough to represent an ecological effect that warranted an action. Based on this assessment, a PRG was developed, only for HBHA Pond, using data only from HBHA Pond. With three data points from HBHA Pond, EPA selected the lowest observed concentration of arsenic associated with adverse effects, found at Station SED-06.

It is correct that in Appendix 7D of the BERA, EPA performed multivariate analyses of the benthic invertebrate data. These results indicated that the two deep water locations in HBHA

Pond were dissimilar with regard to benthic community in comparison to any other site or reference sampling location outside of the HBHA Pond. Hence, as mentioned above, the HBHA Pond is unique, containing sediments with severe toxicity and surface water exceeding NRWQC, which EPA determined to be an unacceptable ecological risk.

> D. 50. The consultant retained by Pharmacia and SMC commented that "National Recommended Water Quality Criteria (NRWQC) for dissolved arsenic were not exceeded in outflow from HBHA Pond under baseflow or storm conditions." Pharmacia reiterated this comment in a separate submission.

EPA Response: See above responses. EPA collectively considered nature and extent, fate and transport, and risk evaluations. Contaminated groundwater plumes (including arsenic and ammonia) discharge into the HBHA Pond and contribute to contaminations and risks at the HBHA Pond and downstream areas. EPA has documented and acknowledged that the NRWQC for arsenic is not exceeded in the surface water outflow from HBHA Pond. However, EPA has documented high concentrations of dissolved arsenic in deep water of the pond at concentrations well above the NRWQC. EPA has also documented in the October 2005 Technical Memorandum – Evaluation of Ammonia and Supplemental Soil Data that the concentration of ammonia, which is very toxic to aquatic life, also exceeds the NRWQC in both the deep water as well as the shallow water (above the chemocline) in the HBHA Pond on a frequent basis. These concentrations of both arsenic and ammonia represent an exceedance of an ARAR, and a risk to aquatic life.

> D. 51. The consultant retained by Pharmacia and SMC commented that "[t]he HBHA Pond in its current condition is currently providing the wetland functions listed in the Massachusetts Wetlands Regulations (310 CMR 10.01(2)) and does not require wetland replication to provide those functions." Pharmacia reiterated this comment in a separate submission.

EPA Response: The sediments throughout the HBHA Pond were extremely toxic and are associated with contaminated groundwater discharges originating from the Industri-plex site. EPA's ecological risk assessment identified these sediments as presenting an unacceptable ecological risk to benthic organisms. Due to the sediment toxicity and surface water quality exceedances of the NRWQC, EPA does not concur that the wetland functions and values are being protected in the HBHA Pond under current conditions.

Due to sediment contaminant concentrations in both deep and shallow water and the periodic exceedances of the NRWQCs for arsenic and ammonia in surface water, the ability of the HBHA Pond to perform functions of providing wildlife habitat, fisheries habitat and pollution prevention are impaired. The selected remedy includes dredging contaminated sediments from the southern portion of HBHA Pond and restoring the impacted area. A compensatory wetland will be constructed to make up for the lost wetland functions and values in the northern portion of the Pond and capped drainways. The lost functions and values of the southern portion will be restored in place. The degraded functions and values of the northern portion and capped drainways will be mitigated through the construction of compensatory wetlands nearby in the watershed. This mitigation will be consistent with ARARs

The selected remedy incorporates the northern portion of the HBHA Pond into the treatment process, which periodically requires sediments to be removed. Considering these contaminated sediments and future accumulated contaminated sediments will be retained, impact benthic community, and periodically be removed from the northern portion, EPA's selected remedy identified the northern portion as a habitat loss requiring compensation through the construction of alternative habitat within the watershed. EPA's selected remedy for the southern portion of the HBHA Pond requires contaminated sediment removal and restoration. Hence, compensatory mitigation is not necessary for the southern portion.

> D. 52. The consultant retained by Pharmacia and SMC commented that: "the absence of unacceptable ecological risks associated with benzene in groundwater at the West Hide Pile demonstrates that there was no need for USEPA to include enhanced in-situ bioremediation for the West Hide Pile in its Proposed Plan."

EPA Response: Benzene concentrations in groundwater remain elevated at the West Hide Pile, similar to concentrations previously detected in groundwater. EPA's RI identifies that plumes associated with the West Hide Pile (e.g., benzene, arsenic, ammonia) likely discharge to nearby wetlands (e.g. southern pond). Insufficient groundwater data and no surface water data were available to assess the extent of the impact of the West Hide Piles groundwater plumes on surface water and sediments. Further predesign investigation will be necessary for the area to evaluate West Hide Pile and East Hide Pile groundwater impacts on the surface water and sediments and impacts to the downgradient plumes.

> D. 53. The MBTA commented that "EPA should assess the risk associated with potential ammonia contamination and should specifically address the risk posed to a construction worker (for example working within a trench) who could be exposed to ammonia contaminated soil and groundwater/surface water...."

EPA Response: EPA evaluated the potential risk and hazard associated with construction worker contaminant exposures (ingestion, dermal contact, and inhalation exposure routes) in the MSGRP RI human health risk assessment. Arsenic was the only contaminant associated with risk management exceedances. Ammonia was not included as part of the MSGRP RI risk assessment. However, the maximum detected concentration of ammonia in groundwater (2,710 mg/L) was evaluated as part of the October 2005 Technical Memorandum – Evaluation of Ammonia and Supplemental Soil Data. Because the potential contribution from ammonia was four orders of magnitude less than conservative screening criteria, ammonia was not selected as a contaminant of concern for the construction worker scenario. Therefore, additional risk characterization information was not included for this receptor.

> D. 54. The ASC's consultant stated that: "the last-minute nature of ammonia's inclusion has prevented EPA from evaluating the potential effects of ammonia, particularly as a contributing source to overall eutrophication of the Aberjona River watershed....We encourage EPA to further consider the role of ammonia as a nutrient source potentially detrimental to the health of the Aberjona's ecosystems."

EPA Response: See EPA Response to Comment F.15, below.

> D. 55. The ASC's consultant stated that: "[c]omments made by others erroneously calculate – and greatly exaggerate – the effects of combining upper-bound assumptions in the human health risk characterization."

EPA Response: See EPA response to comment D.35, above.

> D. 56. The ASC's consultant states that: [o]n page 3-5 of the October 2005 "Evaluation of Ammonia and Supplemental Soil Data," EPA states that arsenic was not detected in any of the twelve soil samples collected at the Rifle Range. The detection limits of these samples, however, ranged from 19 to 32 mg/kg. These detection limits are too high to judge whether these soil may have been impacted above background levels, as the "natural" concentration of arsenic in soils in Massachusetts averages about 5 mg/kg. These samples should be re-analyzed to obtain better detection limits."

EPA Response: The goal of the soil sampling in this area was not to determine whether upland soil arsenic levels were consistent with background but rather to determine whether arsenic was present at levels associated with a risk management exceedance. Soil arsenic detection limits were adequate to determine whether arsenic was present at levels associated with risk or hazard in excess of risk management criteria.

> D. 57. The ASC's consultant questioned: "Has EPA tested for the presence of H_2S in groundwater, and evaluated the possibility that H_2S off-gassing might present potential human health risks to receptors such as the car wash workers (and other potential users of groundwater), especially since the Reference Concentration for H_2S is quite small (about 2 ug/m^3)? If H_2S is potentially present, it should be added as a contaminant of potential concern."

EPA Response: EPA's Office of Research and Development conducted limited analyses of groundwater samples for hydrogen sulfide including conducting field measurements at 18 groundwater sample locations along with vertical profile sampling within the north and central portions of the HBHA Pond water column. Hydrogen sulfide was not detected within the HBHA Pond water column. Although low detections of hydrogen sulfide were sporadically observed in groundwater, EPA does not believe that the low concentrations of hydrogen sulfide would be sustained due to the geochemical conditions observed (and previously reported) in groundwater throughout the Industri-plex site. Specifically, the presence of hydrogen sulfide in groundwater is limited by the elevated concentrations of ferrous iron throughout the site, which results in rapid precipitation of iron sulfides within the aquifer and sediments of the HBHA Pond. Evidence for this process is documented for sediments collected from the northern portion of the HBHA Pond within the zone of plume discharge (Wilkin and Ford, 2002). Based on these data, EPA does not believe that hydrogen sulfide would be present at concentrations that would contribute significantly to human health risk and therefore, is not considered a contaminant of concern.

> D. 58. The consultant retained by Pharmacia and SMC commented that: "USEPA used a 95% upper confidence limit (UCL) of ammonia in groundwater of 316 mg/L in their risk calculations. If only data from the B-1 zoned areas (all of which are from the B-1 #1 area) are used, the resulting 95% UCL concentration is 6.54 mg/L..."

EPA Response: See EPA response to comment D.35.

> D. 59. The consultant retained by Pharmacia and SMC commented that: "USEPA must also consider the form of ammonia that is in groundwater. USEPA's modeling does not account for the fact that below pH 9.25, ammonia exists largely as the ammonium ion (NH_4^+) in solution (Snoeyink and Jenkins, 1980)....This is a critical distinction because ammonium is not volatile and therefore would not be present in the air due to volatilization."

EPA Response: The form of ammonia in water is both pH and temperature dependent with both higher temperature and pH favoring the unionized (volatile) form. Should groundwater be withdrawn and used as process water or in a warm water car wash, the pH and temperature of the groundwater may be altered such that a higher percentage of volatile ammonia is present than exists natively. In addition, as volatile ammonia is released, there will be equilibrium partitioning that will result in the further conversion of ionized ammonium into volatile ammonia in a time-dependent manner. Because a car wash scenario may involve the warming of groundwater, the mixing of groundwater with soap solutions with basic properties, and the used water may remain in the washing area for a period of time allowing for extended volatilization time, EPA conservatively assumed that future conditions may exist that result in the near complete volatilization of ammonia from groundwater.

> D. 60. The consultant retained by Pharmacia and SMC commented that: "USEPA should emphasize the conservatism inherent in the ammonia RfC. The ammonia RfC is based on relatively mild, reversible respiratory effects such as respiratory irritation, and on a single NOAEL exposure level. These observations, coupled with the use of an uncertainty factor of 30, reflect the conservatism inherent in the ammonia RfC."

EPA Response: The current EPA-recommended inhalation reference concentration for ammonia was used in the evaluation. The data upon which this toxicity value is based has been extensively reviewed within the scientific community and the recommended value represents that most defensible estimate of the non-carcinogenic hazard of this compound.

> D. 61. The consultant retained by Pharmacia and SMC commented that: "ammonia concentrations at or below 37 mg/m^3 (USEPA's estimated exposure concentration) for extended durations are well below levels that cause serious or permanent adverse effects....There are no reported cumulative effects from repeated exposure to ammonia at the concentrations modeled by USEPA..."

EPA Response: The baseline risk assessment was prepared in accordance with EPA guidance documents. The selection of toxicity values and the evaluation of receptor-specific hazard are to protect against both serious/permanent and less serious/transient health effects. The EPA-recommended ammonia toxicity value is protective of both types of health effects.

> D. 62. The consultant retained by Pharmacia and SMC commented that: "USEPA should also compare the estimated ammonia exposure concentrations to occupational exposure guidelines, to provide additional perspective on the likelihood of adverse health effects."

EPA Response: The baseline risk assessment was prepared in accordance with EPA guidance documents and adequately evaluated the potential hazard to a commercial worker.

> D. 63. The consultant retained by Pharmacia and SMC commented that: "EPA relies upon an evaluation of ammonia concentration data collected primarily between 1999 and 2001 in the Halls Brook Holding Area Pond (HBHA Pond). No data are presented or analyzed by USEPA for locations further downstream in the Aberjona River watershed. Therefore, the USEPA analysis does not address potential impacts to aquatic life in those portions of the Aberjona River watershed that are appropriate for aquatic life....Measured instantaneous ammonia concentrations [presented in a recent Master of Science Thesis by M. Cutrofello in August 2005] exceeded the applicable 30-day average CCC in amounts that were statistically significant only during 1 of 7 sampling events at HBHA Pond Outlet and 1 of 8 sampling events at HBHA Wetland Outlet. Of 23 samples collected from the Aberjona River at Route 128, immediately downstream of the HBHA Wetland, none exceeded the applicable 30-day average CCC for ammonia. Further downstream on the Aberjona River, there were no instantaneous measurements of total ammonia that exceeded the calculated CCC at any of the stations sampled."

EPA response: EPA used ammonia data collected between 1999 and 2001 due to the intensive studies carried out in HBHA Pond to evaluate temporal and spatial distributions in chemical gradients. However, EPA also collected additional ammonia data in HBHA Pond and tributaries to HBHA Pond in 2004 and 2005. Based on EPA's data, most exceedances of the CCC and CMC for ammonia were in deeper water of HBHA Pond, although exceedances of up to 4-fold the CCC were observed in the HBHA Pond outlet in 3 out of 5 samples collected. These data appear to be generally consistent with the data presented by Cutrofello (2005).

E. Questions and Comments Concerning the Preferred Remedy

> E. 1. The ASC inquired whether the type of remedy proposed had been utilized elsewhere and if so, if there is any statistical analysis demonstrating its effectiveness. The ASC's consultant commented that it is unaware of similar remedies being implemented elsewhere, and whether or not the utilization of a system like the HBHA Pond to contain contamination is a "tried and true process."

EPA Response: The components of the remedial action have been widely and successfully implemented at other sites around the country such as in-situ enhanced bioremediation, permeable cap to prevent contaminated soil erosion and downstream migration of contaminants of concern, impermeable cap to prevent contaminated groundwater infiltration and downstream migration of contaminants of concern, dredging and off-site disposal of contaminated sediments,

etc. The principal treatment mechanisms associated with the selected remedy for HBHA Pond involve aeration, precipitation and biological degradation which are commonly used at groundwater and waste water treatment plants throughout the country. Constructed wetlands have also been used as a method of treating contamination using natural processes occurring in a wetland system. In addition, EPA's Office of Research and Development has monitored the conditions within the HBHA Pond which demonstrate the selected remedy will work and achieve the cleanup standards. Please refer to EPA publication EPA832-R-93-005 where 17 case studies were evaluated for constructed treatment wetlands.
The problems at the Industri-plex site are unique and EPA is unaware if a similar system using all of these various components exists elsewhere in the country. However, we note that the natural processes that exist in the HBHA Pond have been shown to be somewhat effective in sequestering arsenic and reducing other COCs. EPA's goal is to assist and enhance these processes while restoring as much of the HBHA Pond and wetland as possible. Notwithstanding the above, at least every five years, EPA will evaluate the conditions at the site and determine if the selected remedy is protective of human health and the environment.

E. 2. One commenter associated with the Woburn Conservation Commission noted that there was nothing in the Proposed Plan detailing the following: management of contaminated soils, the location and design of replicated areas for wetlands mitigation, and treatment of any archaeological findings, and also requested that EPA coordinate its work in wetlands with the Woburn Conservation Commission.

EPA Response: The specific details of the selected remedy as mentioned in the comment (i.e., planting schemes, waste handling procedures, monitoring, etc) will be provided in the remedial design. EPA will continue to coordinate with all stakeholders regarding the selected remedy. EPA notes that remedial actions under the Superfund program are generally exempt from local permits.

E. 3. One Woburn City Alderman asked what will happen to the waste causing the groundwater contamination (upstream of the HBHA Pond).

EPA Response: The capped and buried organic waste (animal hide residues) and soils contribute to groundwater plumes. These capped and buried organic waste and soils will remain in place serving as a long-term source to the contaminated groundwater plumes. Hence, the contaminated groundwater plumes are expected to persist indefinitely.

E. 4. One Woburn City Councilor asked if there was a backup plan in place should the cofferdam system fail. The ASC's consultant commented that EPA should be prepared to deal with unexpected findings and consequences, and asked if there was a backup plan.

EPA Response: Long-term monitoring will ensure that the remedy remains effective and that the conditions that the remedial design is based upon do not change or alter the performance of the remedy. In addition, a comprehensive review will be conducted at least every five years to evaluate the protectiveness of the remedy. The purpose of the five-year review is to evaluate the implementation and performance of the remedy in order to determine if the remedy is or will be protective of human health and the environment. The five-year review will document recommendations and follow-up actions as necessary to ensure long-term protectiveness of the remedy or bring about protectiveness of a remedy that is not protective. These recommendations could include providing additional response actions, improving O&M activities, optimizing the remedy, enforcing access controls and institutional controls, and conducting additional studies and investigations. For example, if under the selected remedy, the NRWQC values cannot be achieved at the HBHA Pond compliance point, then additional actions may be required. If different remedial actions are necessary, then other remedial alternatives, such as GW-3 Plume Intercept by Groundwater Extraction, Treatment and Discharge and Monitoring with Institutional Controls coupled with HBHA-5 Removal and Off-Site Disposal, outlined in the June 2005 FS, may be considered.

E. 5. The ASC asked if there were more detailed designs plans available beyond that which is contained in the Proposed Plan. The ASC's consultant commented that there is almost no detailed design information to comment upon.

EPA Response: The design stage of the process will occur after the Record of Decision is issued, and will be available for public review.

E. 6. The ASC's consultant commented that because a large amount of waste will be left in place, it depends strongly on continued risk and land management.

EPA Response: The comment is noted. EPA recognizes that waste will remain in place and require long-term monitoring. The Feasibility Study evaluated all alternatives based upon 30 years. However, some aspects of the remedial action and monitoring will extend beyond 30 years due to the waste remaining in place.

E. 7. The ASC's consultant commented that because monitoring is a crucial aspect of the proposed remedy, it should be given the opportunity to review and comment upon the specific details of the monitoring program.

EPA Response: Monitoring is an important component of the selected remedy, and is generally described in the description of alternatives in Section 3, Section 4, and Appendix B of the FS. An EPA-approved monitoring program will be performed consistent with previous RI monitoring methods and procedures so that on-site and off-site contaminant trends and migrations patterns can be adequately evaluated and compared to previous RI data. Monitoring will also be performed to evaluate the performance of the selected remedy. Specific details of the monitoring program will be developed during remedial design process.

E. 8. The ASC's consultant asked who is going to oversee the capping and the construction, who will be responsible for giving permits for construction on these sites, and whether the City of Woburn would be responsible for those matters.

EPA Response: EPA, in consultation with the Commonwealth of Massachusetts, will oversee the remedial design and remedial action. Under the Superfund program, remedial actions are generally exempt from local permitting requirements. As indicated in the above responses, EPA believes public participation is an important aspect of the Superfund process that will continue at this site and encourages involvement of the local authorities during the design and construction phases of the project.

> E. 9. The ASC's consultant commented that: "Alternative HBHA-4 involves significant physical disturbance of the Halls Brook Holding Area (HBHA) pond, which raises a concern about whether the existing chemical stratification and the predominant redox chemistry of the pond can be maintained."

EPA Response: An important aspect of the selected remedy for HBHA Pond is ensuring that baseflow surface water from Halls Brook continues to discharge into the northern portion of the HBHA Pond, which helps to maintain the chemocline at a depth of approximately 150 – 200 cm below the pond's surface. The selected remedy re-directs Halls Brook storm surface water flow to the southern portion, but maintains baseflow conditions in the northern portion. EPA agrees that significant, frequent, and careful monitoring of the water quality and redox parameters in the HBHA Pond is an important aspect of the remedy. The specific details of the monitoring program will be provided in the Remedial Design.

> E. 10. The ASC's consultant commented that: "t]he Proposed Plan suggests that EPA's proposed Alternative GW-2 for groundwater, when combined with HBHA-4, 'also controls the downstream migration of contaminated groundwater by intercepting it at the northern portion of the HBHA pond' – however, the cofferdam will not intercept arsenic in groundwater discharging directly to the south basin."

EPA Response: The location of the low-head cofferdams presented in the Proposed Plan and selected remedy is conceptual and approximate based on the available groundwater data. The final location of the low-head cofferdams will be determined during the pre-design field investigations and will intercept the contaminated groundwater plumes being released from the Industri-plex site (e.g., arsenic, benzene, ammonia). Also, the presence of arsenic at the bottom of the HBHA Pond does not necessarily correlate directly to the presence of the arsenic groundwater plume. The chemocline within the HBHA Pond keeps contamination at depth, and the dissolution and precipitation cycling processes below the chemocline contribute to the broad distribution of high arsenic concentrations throughout the bottom of the pond.

> E. 11. The ASC's consultant commented that: "[t]he proposed remedial plan does not address high concentrations of dissolved total ammonia (NH_4^+ plus NH_3) entering the north basin in groundwater."

EPA Response: Consistent with the October 2005 Technical Memorandum – Evaluation of Ammonia and Supplemental Soil Data, EPA agrees that ammonia concentrations in groundwater and surface water are high and ammonia is a contaminant of concern. See EPA's previous response above regarding ammonia as a contaminant of concern. EPA's selected remedy will address the ammonia in surface water and groundwater above the cleanup standards. It should be noted that while ammonia may be competing with arsenic for available oxygen in surface water at HBHA Pond as suggested in the comment, the current levels of oxygen have been adequate to support the reactions necessary to significantly decrease the concentrations of both dissolved arsenic and ammonia. The aeration treatment system will provide an additional source of oxygen that will further enhance those reactions. The complex chemistry associated with the ammonia and other compounds will be evaluated further during the pre-design stage to ensure the remedy is most effectively and efficiently designed.

> E. 12. The ASC's consultant commented that: "[t]he Feasibility Study does not describe the plans for reducing risks posed by the sediments and chemolimnion in the north basin after the PRGs for GW-2 have been reached."

EPA Response: The selected remedy requires institutional controls to reduce the risk associated with human exposure to contaminated groundwater. Groundwater treatment is not specified. Since the source of groundwater contamination (buried wastes and animal hides) is to remain in-place, groundwater is not expected to achieve the groundwater cleanup standards through natural attenuation processes in the foreseeable future. The low-head cofferdams will be maintained and the northern portion of the HBHA Pond will require periodic dredging. In the unlikely event groundwater cleanup standards are achieved and the low-head cofferdams are no longer required, then sediments remaining that exceed the sediment cleanup standard would be dredged at the time the cofferdams are removed and the impacted area would be restored.

> E. 13. The ASC's consultant commented that: "[t]he justification for the 30-year design-life of the chemolimnion/retention pond system has not been provided in the Feasibility Study. "

EPA Response: The 30-year design-life is a consistent standard used for comparing all alternatives, and does not represent how long a remedial alternative will be required to operate. Due to the interactions between GW and HBHA alternatives (groundwater plumes discharge into and impact sediments and surface water in the HBHA Pond), these alternatives were considered together. While all of the GW alternatives (and the HBHA-4 alternative) have a consistent 30-year design life, the designed systems for the remedy are expected to be operated and maintained beyond 30 years because buried waste remains in place at the Industri-plex site. It is impossible to accurately estimate how long these systems will need to function, hence, EPA assumes with the waste remaining in place that the systems will need to function for the foreseeable future.

> E. 14. The ASC's consultant commented that: "[e]stimates of the volume of contaminated sediment to be removed in proposed Alternative NS-4 are based on the analyses of a very limited number of samples."

EPA Response: The estimated areas requiring remediation were based on samples spaced approximately 50 to 75 feet apart. As stated in the Feasibility Study, a pre-design investigation will be conducted to more closely delineate the extent of sediment contamination exceeding the sediment PRG and requiring removal. The results of this investigation will serve as the basis of the Remedial Design. In addition, confirmatory samples will be collected during sediment removal activities to ensure that contaminated sediments exceeding the sediment cleanup standards have been removed from the targeted areas defined in the FS.

E. 15. The ASC's consultant commented that: "[r]egardless of which alternative is implemented for surface water, automated sampling stations should be established at several locations for ongoing monitoring of remedial progress."

EPA Response: A surface water monitoring program similar to the one implemented during the MSGRP RI will be conducted as part of the remedy. The specific details of the monitoring program will be developed during the remedial design phase. This approach will provide surface water data that can be compared to the existing surface water data set. This approach will also satisfy community concerns regarding monitoring downstream of the remedy.

E. 16. The ASC's consultant asked whether the design of the storm water bypass considered dense storm water during cold weather.

EPA Response: EPA has monitored the geochemical conditions of the HBHA Pond during summer periods and has not identified this as a concern. See Robert Ford's September 2004 Natural Attenuation Study (Appendix 2D in the MSGRP RI). EPA also wishes to clarify that the Proposed Plan and the selected remedy are not intended to be detailed technical designs. Remedial Design will occur in the future. In addition, pre-design investigations will be necessary to complete the final design of the system. The impacts of colder storm water on the system is one of the design parameters that will be evaluated further. Long-term monitoring will also be a necessary component of the overall system, and will be addressed during the remedial design phase.

E. 17. The ASC's consultant commented that: "EPA should require that the cofferdams be designed to withstand the effects of ice."

EPA Response: The low-head cofferdams that are constructed in the HBHA Pond will be designed to resist the impacts of ice or any other natural forces to which they would be exposed (e.g. hurricanes, significant flooding, heavy debris from storm events). The specific design details, including the actual location and orientation of the low-head cofferdams and the type of material utilized to construct the cofferdams, will be developed during the Remedial Design process.

E. 18. The ASC's consultant commented that: "Sediment Retention Area at Northern Portion of the HBHA Pond: on page 3-31, paragraph 1 of the Feasibility Study (Section 3.4.5.2) it is written that 'construction of baffles/flow deflectors or installation of floating silt curtains around which surface water flow would be directed, resulting in lower flow velocities as surface water moves toward the southern end of the pond.'

This statement is not correct. Since $Q_{in} = Q_{out}$ in the north basin, flow velocities around baffles and curtains will increase. Travel distances (and hence hydraulic residence times) will increase, which may enhance particle settling, but velocities will not be reduced. Two related questions: (1) what size particles will be removed by the proposed retention basin, and (2) what are the hydraulic residence and particle settling times in the north basin? Because the answers to these questions will impact the effectiveness of the retention basin to remove particulate arsenic, in the absence of this data it is not possible to judge the feasibility of the proposed retention basin to meet the PRG for surface water flowing to the south basin."

EPA Response: The above-mentioned phrase should read: "...*construction of baffles/flow deflectors or installation of floating silt curtains around which surface water flow would be directed, to* promote the settling of particulate arsenic." The last sentence of the first paragraph on Page 3-31 can be ignored.

In reference to the two additional questions, the proposed location of the low-head /s is presented as preliminary and conceptual, based on the discharge of contaminated groundwater. The actual location of the low-head cofferdams is subject to change based on further evaluation of the groundwater and residence time required to provide adequate removal of suspended sediment to achieve the remedial action objectives. Pre-design investigations will also be conducted to optimize the sediment retention system. It is important to note that the primary compliance aspects of the northern portion of the HBHA Pond and its low-head cofferdams system (including the northern/first low-head cofferdam (primary treatment area/cell) and southern/second low-head cofferdam (secondary treatment area/cell)) are three fold: 1) the first low-head cofferdam (primary treatment cell) is located to intercept the contaminated groundwater plumes discharging in the HBHA Pond; 2) the chemocline within the primary treatment cell will be maintained (e.g., storms flows from Halls Brook be diverted from the northern portion of the HBHA Pond to the southern portion (downstream of the primary and secondary treatment cells), periodic dredging within the primary treatment cells); and 3) the effluent from the second low-head cofferdam (secondary treatment cell) comply with surface water cleanup standards (including NRWQC), and periodic dredging within the secondary treatment cell to maintain compliance with the cleanup standards/remove accumulated sediment.

E. 19. The ASC's consultant commented that: "by not allowing chemolimnion to spill over from the north basin to the south, the volume of the chemolimnion will increase, and the chemolimnion level will rise up in the north basin impacting more of the pond."

EPA Response: The chemolimnion/chemocline is not expected to increase in volume as stated in the comment. A scenario that may cause the chemocline to "spill over" the coffer dam may be the result of accumulated sediment that effectively decreases the depth of water and increases the elevation of the chemocline. Accumulated sediment depth will be monitored and periodically dredged to ensure spill over does not occur. This question will need to be evaluated further during predesign investigations.

EPA's selected remedy also requires the construction of compensatory wetlands for any wetland function and value losses associated with the remedy, including any loss flood storage capacity.

E. 20. The ASC's consultant asked how the frequency of sediment dredging will be determined.

EPA Response: The initial frequency of dredging will be determined during remedial design and will be closely monitored during the life of the remedy including the primary and secondary treatment cells in the northern portion of the HBHA Pond. As indicated above, the dredging frequency will be determined by closely monitoring the chemocline, surface water conditions in the northern portion, and sediment accumulation.

EPA anticipates that, in addition to other design and performance criteria that will be detailed in the remedial design, conditions that may trigger dredging in the northern portion of the HBHA Pond will be: 1) if the chemocline rises to within 100 cm of the northern/first low-head cofferdam outlet (primary treatment cell); or 2) concentrations of surface water effluent from the southern/second low-head cofferdam (secondary treatment cell outlet) exceeds the surface water performance standards (e.g., NRWQC). EPA expects that other interim measures will be evaluated and possibly implemented prior to dredging in order to protect the integrity of the chemocline and ensuring compliance with the performance standards. Frequent long-term monitoring will be necessary to monitor the system. These interim steps (for example, actions other than dredging) may temporarily postpone the need for dredging operations, until the interim steps are no longer effective and excessive sediment accumulation within primary and/or secondary treatment cells requires dredging.

It should be noted that a portion of the sediments helps to release some iron-oxides and promote microbial degradation, which suggests that when dredging becomes necessary, only partial dredging should be implemented sufficient to lower the elevation of the chemocline and provide further sediment retention capacity. Also, dredging should only be implemented when necessary to ensure the selected remedy is functioning appropriately, achieving the remedial action objectives and standards, and the chemocline remains low in the water column ensuring no elevated releases of contaminants of concerns downstream of the HBHA Pond.

EPA anticipates that hydraulic dredging will be implemented in the northern portion of the HBHA Pond, and dewatering the northern portion will not be necessary. Water generated during dredging would require testing and, if necessary treatment, prior to discharge. As stated in the FS, specific methods for dredging, materials handling, treatment of water, etc. will be addressed in the remedial design.

> E. 21. The ASC's consultant commented that it is not clear if the aeration system between the two cofferdams will be effective. "… The water will contain very high levels of ammonia, sulfides, and reduced iron, which will all compete with arsenic for oxygen. It is likely that advanced oxidation process – e.g., UV-peroxide oxidation – will be required to effectively oxidize the arsenic moving downstream from the first cofferdam to the second. Also, it is not clear if the aeration system will be operated all year long or if it will be shut off periodically (e.g., during the winter months). Lastly, it is written that 'Periodically, the secondary sediment retention area may also require dredging,' but it is not clear how the frequency of dredging will be determined. EPA should address these questions in the Feasibility Study."

EPA Response: Based on the available surface water data, the shallow water does not contain "very high levels of ammonia" as stated in the comment. It is currently anticipated that aeration will assist the existing natural attenuation processes occurring in the HBHA Pond in achieving the Remedial Action Objectives (RAOs) and surface water cleanup standards at the point of compliance (i.e., the outlet of the southern/second low-head cofferdam (secondary treatment cell)). A pre-design investigation will be required in the ROD to further evaluate the water chemistry and provide the basis for the actual full scale remedial design of the low-head cofferdams and aeration system. In addition, once installed, a comprehensive monitoring program will be implemented to evaluate the effectiveness of the system in meeting the RAO and cleanup standards. Currently it is assumed that the aeration system will be operated year-round. Regarding dredging, accumulated sediment within the secondary treatment cell will be monitored for depth as well as contaminants of concern. The frequency of dredging the secondary treatment cell will be determined based on the accumulated depth of sediments and concentrations of surface water effluent exceeding the surface water performance standards (e.g., NRWQC). Dredging of the secondary treatment cell could also be based on other factors such as the dredging frequency of the primary treatment cell (the sediment retention area for the Northern Portion of the HBHA Pond include the primary and secondary treatment cells). For example, for purposes of cost efficiencies, it is possible that the secondary treatment cell will be dredged at the same time the primary treatment cell. It is also possible that the secondary treatment cell may need to be dredged more frequently then the primary treatment cell.

E. 22. The ASC's consultant commented that: "EPA does not adequately describe the long-term monitoring and maintenance program for Alternative HBHA-4."

EPA Response: The specific details of the comprehensive monitoring program will be developed in the Remedial Design.

E. 23. The ASC's consultant commented that: "Section 3.4.5.2 (Sediment Retention Area at Northern Portion of the HBHA Pond), on page 3-31, paragraph 2, describes "construction of a dual low-head cofferdam system starting at the approximate location of the mouth of the Halls Brook and continuing west across HBHA Pond... with the northern portion serving as the sediment retention and secondary polishing area." It should be noted that Hall Brook enters HBHA on the western shore; thus, if the cofferdam is constructed from the brook outlet across the pond, construction will proceed to the east and not the west."

EPA Response: The comment is acknowledged and EPA agrees with the comment. However, since the error does not change the outcome of the FS, the document will not be revised.

E. 24. The ASC's consultant commented that: "Page 3-31, paragraph 3, makes reference to 'diffusion from accumulated sediments and subsequent chemocline precipitation.' It is not clear what is meant by these statements and what they refer to. It appears that this phrase was inadvertently appended to the sentence in which it appeared."

EPA Response: The comment is acknowledged and the phrase should be ignored. However, since the error does not change the outcome of the FS, the document will not be revised.

E. 25. The ASC's consultant commented that: "[o]n page 3-31, paragraph 3, sentence 3, it is not clear how the sediment storage figure of '2,000 yd^3 of in-place sediment per vertical foot' is arrived at. Is this an estimate arrived at from carefully performed measurements and calculations, or is this simply a rough estimate? EPA should describe how the sediment storage volume was estimated."

EPA Response: This estimate provided is a rough estimate of the in-place volume of sediment that would accumulate over the estimated area of the settling basin that is presented in the FS report. The surface area of the sediment retention basin that is depicted in the FS is approximately 56,000 square feet. One foot of sediment depth represents an average estimate of sediment depth assuming that the sediment thickness will be greater towards the center of the pond and lesser near the shores.

56,000 SF x 1 Vertical Foot = 56,000 Cubic Feet (CF)
56,000 CF x 1 CY/27 CF = 2,074 CY

E. 26. MassDEP recommended "dredging the entire pond including the proposed groundwater treatment area [Northern Portion of the HBHA Pond containing the primary and secondary treatment areas/cells] prior to installing the cofferdam. Dredging the entire pond would immediately increase the remedial capacity of the northern section of the pond, potentially ensure that Responsible Party funds would be used to do the dredging, and extend the time period that will be needed before the next dredging will have to take place."

EPA Response: While EPA agrees that dredging the northern section of the pond would create additional sediment retention capacity, EPA is concerned about upsetting the current balance of conditions that assist in sustaining the chemocline and processes accounting for the removal of contaminants. The current in-place sediments represent an arsenic sink and can account for some limited removal of arsenic discharging into the pond from groundwater. The sediment layer, which hosts iron- and sulfate-reducing bacteria, impact arsenic removal within the HBHA Pond in two ways: 1) by supplementing the concentration of ferrous iron (provided primarily by groundwater discharge) that is transported to the chemocline through reductive dissolution of settling iron oxides; and 2) by contributing to the formation of reduced Fe-bearing minerals such as ferrous iron sulfides that sequester a fraction of the dissolved arsenic that accumulates at the bottom of the water column. Complete removal of these sediments and the associated microbial community that has evolved over the life of the HBHA Pond may result in a decrease in the concentration of dissolved ferrous iron in the water column and possibly an increase the concentration of dissolved arsenic. The efficiency of arsenic removal observed near the chemocline is dependent on the relative concentrations of dissolved ferrous iron and arsenic. A significant change to this balance, i.e., a decrease in the ratio of ferrous iron to arsenic, could negatively impact the effectiveness of the selected remedy.

E. 27. MassDEP "questions the need for a cap along the northern bank of the HBHA (which will need long term maintenance, inspections and possibly institutional controls—see Figure 4-3 of the Proposed Plan). Since the bank do not pose an ecological or human health risk, why not continue to let any soil that dislodges from this area end up in the northern treatment area [primary and secondary treatment cells] and settle out? This sediment will eventually be dredged along with the accumulated groundwater treatment

> sediment in the northern section of the HBHA anyway. If EPA believes that this sediment won't settle within the northern basin and will instead pose a risk by suspending and washing downstream during storm events, then DEP recommends dredging that northern bank along with the sediment of the HBHA in the initial dredging operation."

EPA Response: EPA identified soils along the northern bank of the HBHA Pond (i.e. Area A6) that contain arsenic concentrations greater than the HBHA Pond sediment cleanup standard (273 ppm). The selected remedy requires a permeable cap be placed along contaminated soils (e.g. the northern banks of the HBHA Pond along the southern boundary of the Boston Edison right-of-way and adjacent to the railroad right of-way west of the HBHA Pond (e.g., Area A6)) to prevent soil erosion (i.e. soils exceeding the sediment cleanup standards), additional loading of contaminated sediments to the primary and secondary treatment cells, downstream migration of contaminants of concern, and potential impacts to other components of the selected remedy. EPA's selected remedy addresses the remedial action objectives, and is cost effective. MassDEP suggests excavating/ dredging the soils and off-site disposal along with sediments dredged with HBHA Pond. EPA believes the soil removal/excavation, off-site disposal, and restoration could adequately address the remedial action objectives, but believes the option would be more costly.

> E. 28. MassDEP recommended "that EPA alter the plan for capping of the New Boston Street Drainway to reduce the need for maintenance and possible ICs. The benefits of the capping are not sufficiently substantiated. For example, if the groundwater is prevented from entering the NBSD (which is the purpose of the impermeable cap) there is not an evaluation as to the alternative endpoint of that groundwater. DEP requests that the NBSD not be capped, and instead culvert the NBSD to confluence with the Atlantic Ave Drainway, the northern treatment area [primary and secondary treatment cells] of the HBHA, or the aeration section between the coffer dams. This will ensure that the flow from the NBSD will end up in the treatment area of the HBHA. The Remedial Investigation concluded that most of the increased flow into the HBHA during storm events is from Hall's Brook, so presumably the diversion will not upset the chemocline in the northern section of the HBHA."

EPA Response: EPA determined that contaminated groundwater may discharge into drainage channels (e.g. New Boston Street Drainway) and contribute to contaminant migration downstream. Some sediment within the New Boston Street Drainway exceed sediment cleanup standards for the HBHA Pond (e.g., arsenic above 273 mg/kg). The selected remedy requires the design and construction of impermeable caps to line stream channels (e.g. New Boston Street Drainway), and to prevent contaminated groundwater plumes discharge into surface water, downstream migration of contaminants of concern and potential impacts to other components of the selected remedy. EPA's selected remedy addresses the remedial action objectives, and is cost effective.

Based on geologic and hydrogeologic studies conducted during the GSIP and MSGRP investigations, EPA believes that groundwater would flow under the capped portion of the New Boston Street Drainway (NBSD) and discharge into the northern portion of the HBHA Pond and would not reduce the need for institutional controls for groundwater use restrictions. Culverting the NBSD so that the flows discharge directly into Atlantic Avenue Drainway or the Northern

Portion of the HBHA (primary and secondary treatment cells referenced in MassDEP's comment as "northern treatment area" and "aeration section", respectively) as suggested would present significant construction issues and costs resulting from crossing the active commuter rail line, crossing through areas of known soil contamination creating soil management and disposal issues, creating additional costs resulting from the management of potentially significant quantities of contaminated groundwater generated during dewatering activities, and result in significantly greater costs in construction materials. In addition, a portion of the NBSD would still require filling or capping to prevent contaminated groundwater discharges thus possibly requiring long-term maintenance issues that would still trigger the need for ICs. Also, if the NBSD is filled-in to prevent groundwater from discharging into the existing stream channel and flowing to Halls Brook, then additional mitigation would be required further adding to the costs.

Under EPA's selected remedy, increased flows associated with storm events contributed by the Halls Brook (including flows from the NBSD) would bypass the Northern Portion of the HBHA Pond (primary and secondary treatment cells). The MassDEP suggests that their proposed diversion will not upset the chemocline if the NBSD is allowed to directly discharge into the "treatment area of the HBHA" Pond. However, the increased flows and velocities contributed by the NBSD under storm conditions is unknown and may cause scouring, mixing, or destabilization of the chemocline.

E. 29. MassDEP commented that: "[t]he Feasibility Study does not evaluate a remedy for the soil that would involve partial excavation of the soil in the Mishawum lakebed area; rather EPA chose only to excavate everything, or put ICs on all properties. DEP urges EPA to evaluate the potential benefit of excavating a portion of the contaminated surface soil. DEP thought the following two alternatives would increase protectiveness immediately, and eliminate the need for ICs on several properties:

1. excavate and remove surface soil on only vacant properties,
2. excavate and remove surface soil in the area indicated in the plan, excluding the sub-surface contaminated area. Subsequently, place ICs only on the subsurface contaminated soil area."

EPA Response: EPA's selected remedy requires institutional controls in subsurface soil (SUB) area and surface soil (SS) area. The smaller SS area is situated within the boundaries of the SUB area. Removing portions of the SS area will not eliminate the need for institution controls within that area (SUB area will still require institutional controls). In addition, EPA's selected remedy addresses the remedial action objectives and is cost effective. MassDEP's suggestion to excavate portions of the soils from the SS area will significantly increase costs while not eliminating institutional controls.

E. 30. MassDEP noted "that an aerator will be a component of the groundwater/surface water remedy south of the upper cofferdam. Apparently the aerator is needed to increase oxygen levels and increase the precipitation of arsenic. This is potentially a part of the remedy requiring frequent maintenance. Therefore, the DEP recommends a method of aeration requiring the lowest-maintenance possible, and enough flexibility in design to allow for the use of a non-polluting energy source for the aerator (e.g., solar panels)."

EPA Response: The specific design of the aeration or oxygenation part of the remedial alternative will be developed as part of the pre-design investigation and the final remedial design. Maintenance and energy efficiencies will be important factors when evaluating aeration treatment technologies and system configurations. MassDEP will have an opportunity to comment on the design during this period.

> E. 31. The consultant for DEK commented that: "[a] reactive barrier installed as part of proposed remedy GW-4 along the NSTAR Easement to the north of
> the DEK property should be re-considered to protect the DEK property, the HBHA and the downstream sediments in the Aberjona River in the long term, while still retaining remedy GW-2 combined with sediment remedy HBHA-4 to eliminate downstream migration of arsenic bearing sediment in the short term.
> . . . if groundwater impact to the HBHA could be eliminated through upgradient treatment or control of the plume through installation of a reactive barrier as part of remedial alternative GW-4, then the long term impacts of operation and maintenance of HBHA-4 could also be eliminated."

EPA Response: The capped and buried organic waste (animal hide residues) contribute to groundwater plumes. This buried organic waste will remain in place serving as a long-term source of the contaminated groundwater plumes. Hence, the contaminated groundwater plumes are expected to exist for the foreseeable future. EPA evaluated several remedial alternatives to address the risks associated with groundwater including remedies to intercept the groundwater at the current Industri-plex site boundary. Those risks were the result of potential future use of the groundwater as process water or in a car wash scenario. Other technologies and remedial alternatives were extensively evaluated in the FS including the reactive barrier as suggested in the comment. EPA believes that the selected alternative is the best alternative that balances all required evaluation criteria while still addressing the risks.

> E. 32. The MBTA asked why a 16-inch cap is being proposed for elevated metal levels along the Northern Portion of the HBHA Pond, and for the rationale for using a relatively thin soil cap.

EPA Response: The Industri-plex (OU-1) ROD originally required a cap consisting of 30 inches of cover soils. This design requirement was later re-evaluated and revised to include the use of engineered geotextile materials to lessen the cap thickness while maintaining the cap's effectiveness. A similar engineered cap is proposed for the referenced soils.

> E. 33. The MBTA asked for the rationale for only placing 4 inches of topsoil on the cap proposed as part of Alternative HBHA-4 and comments that this is a relatively thin topsoil layer which will require significant monitoring and maintenance to prevent erosion damage.

EPA Response: The required topsoil layer has been sufficient to establish and maintain vegetation in order to prevent erosion throughout the site. See above response to comment.

E. 34. The MBTA asked EPA to describe the cap monitoring and maintenance programs.

EPA Response: The proposed design for the cap is consistent with the cap designs previously designed and installed under Industri-plex OU-1, including those previously installed by the MBTA at the Industri-plex site. The specific details of these designs are included in the 100% Design Report, Industri-plex Site, Woburn, Massachusetts, Remedial Work for Soil, Sediments and Air, dated April 25, 1992, and prepared by Golder Associates, Inc. Regarding caps for Industri-plex OU-2, specific design details and monitoring and maintenance requirements will be specified in the remedial design.

E. 35. The MBTA commented that a "component of Alternative HBHA-4 requires the lining of a portion of the streambed located west of the MBTA railroad tracks with a 40-mil High Density Polyethylene (HDPE) Liner overlain with a 16-inch thick layer of gravel/cobble . . . Please provide the flooding criteria that were considered to assess stream levels during storm events."

EPA Response: The conceptual design for the liner of the stream channel assumes that the stream bed will be excavated in order to install the liner and preserve the current volume capacity of the existing stream channel. A pre-design investigation is intended to evaluate flood storage issues and serve as part of the design basis for the final remedial design. The specific design details will be specified in the remedial design.

E. 36. The MBTA asked whether the EPA considered the potential for structural damage to the railroad tracks, along with the potential for contaminated stormwater to discharge to the right of way (ROW).

EPA Response: The purpose of the liner is to eliminate potential contaminated groundwater from discharging to the stream, which is likely presently occurring, and ultimately discharge to the HBHA. The remedy will not cause contaminated water to discharge to the ROW.

Although not specified in the comment, EPA assumes that "the potential for structural damage to the railroad tracks" referred to in the comment would be the result of construction activities during liner installation. Construction methods and procedure will be specified in the remedial design to prevent structural damage as was the case when approximately 350 linear feet of the NBSD along the ROW was previously capped with a permeable liner during the execution of Industri-plex OU-1 remedy. AMTRAK and MBTA will have an opportunity to review and comment on these designs.

E. 37. The MBTA asked EPA to show the location of the streambed and proposed limit of work in relation to the MBTA ROW, and to explain why only a portion of the streambed is being lined.

EPA Response: Please refer to Figure 4-3 of the FS and the Proposed Plan, and Figure J-7 of this ROD for the estimated location of the proposed stream channels requiring the impermeable cap liner.

As stated above, the purpose of the impermeable cap is to prevent the discharge of contaminated groundwater plumes, contamination of stream sediments, downstream migration of contaminants of concern, and potential impacts to other components of the selected remedy.

> E. 38. The MBTA commented that: "[i]f Alternative HBHA-4 is implemented, a geotextile cushion should be provided between the HDPE liner and the gravel cobble, to help prevent damage and punctures to the liner, which could be caused by the gravel/cobble layer."

EPA Response: Details will be resolved during the predesign and design stage of the selected remedy. MBTA will have an opportunity to review and comment on these designs at that time.

> E. 39. The MBTA asked EPA to "explain how contaminated sediments that will enter the southern portion of the HBHA Pond via the stormwater by-pass structure during storm events will be managed. The Feasibility Study indicates that sediment will be periodically dredged from the sediment retention area, but it is not clear if periodic dredging is also proposed in the southern portions of the HBHA Pond."

EPA Response: The selected remedy for HBHA Pond requires the design and construction of an impermeable cap to line stream channels (e.g. New Boston Street Drainway), and to prevent the discharge of contaminated groundwater plumes, contamination of stream sediments, downstream migration of contaminants of concern, and potential impacts to other components of the selected remedy. Therefore, once the upgradient portions of the selected remedy are constructed and the southern portion of the HBHA Pond is dredged and restored, EPA does not believe the southern portion of the pond will become re-contaminated and require additional dredging. EPA will evaluate the conclusion during the five-year reviews.

> E. 40. The MBTA asked EPA to "explain how the chemo-cline will be maintained in the southern portion of the HBHA Pond during and following storm events. As indicated on page E-6 of the Feasibility Study, the chemo-cline is destabilized during storm events and the amount of metals entering the water column and being transported further downstream is much greater."

EPA Response: Under the selected remedy for the HBHA Pond, a chemocline is not expected to be present within the restored southern portion of the HBHA Pond. The selected remedy intercepts the contaminated groundwater plumes at the primary treatment cell within the northern portion of the HBHA Pond, and prevents the plumes from discharging into the secondary treatment cell and southern portion of the HBHA Pond. Low-head cofferdams will be constructed to help form the primary and secondary treatment cells. After construction of the low-head cofferdams, construction of the primary and secondary treatment cells, and sediment removal and restoration of the southern portion of the HBHA Pond, a chemocline should no longer be present in the restored southern portion.

However, as part of the selected remedy, the chemocline within the primary treatment cell of the northern portion of the HBHA Pond must be maintained. An important aspect of maintaining the chemocline within the primary treatment cell is the construction of a storm water by-pass system at Halls Brook. The by-pass system will divert significant Halls Brook storm surface water flows from the primary treatment cell to the southern portion of the HBHA Pond, which could disturb the chemocline within the primary treatment cell, while maintaining Halls Brook base flow surface water conditions into the primary treatment cell during storm events. EPA's selected remedy will achieve surface water cleanup standards at the outlet of the northern portion of the HBHA Pond (secondary treatment cell outlet).

> E. 41. The MBTA asked EPA to "provide the flooding criteria that are being considered for the implementation of Alternative HBHA-4."

EPA Response: A pre-design investigation is intended to evaluate flood storage issues and serve as part of the design basis for the final remedial design. The specific design details will be specified in the remedial design.

> E. 42. The MBTA asked EPA whether precautions would be taken to help ensure that contaminated stormwater does not discharge to the MBTA ROW.

EPA Response: Under the selected remedy, arsenic contaminated groundwater would be prevented from discharging into the NBSD.

> E. 43. The MBTA asked EPA whether precautions would be taken to help ensure that stormwater flooding will not cause structural damage to the railroad tracks.

EPA Response: A pre-design investigation is intended to evaluate flood storage issues and serve as part of the design basis for the final remedial design. The specific design details will be specified in the remedial design.

> E. 44. The MBTA asked EPA to provide details regarding the proposed dredging work, which will demonstrate that this activity will not cause structural damage to the MBTA railroad tracks and/or ROW.

EPA Response: A pre-design investigation is intended to evaluate flood storage issues and serve as part of the design basis for the final remedial design. The specific design details will be specified in the remedial design.

> E. 45. The MBTA asked EPA to provide a complete set of design documents for each of the preferred alternatives when completed to review them and provide comments.

EPA Response: The remedial design documents will be available to all interested parties, once completed.

> E. 46. The City of Woburn, Mayor's Office, commented that: it "does not question the ultimate goal of the remedy the Environmental Protection Agency has proposed. The concept and premise of the design seem sound. However, one area of concern is the amount of dredging proposed within the Halls Brook Holding Area. There appear to be

> two schools of thought. One being that the best remedy involves the complete removal of all contaminated sediments and the other being that the very act of removal may cause a greater risk for release of sediments downstream."

EPA Response: The selected remedy will address remedial action objectives and cleanup standards. We agree that it is critical to ensure that dredging does not itself cause further adverse impact. The remedial design will specify construction methods, materials, and performance goals to ensure that implementation of the plan will not cause downstream migration of contamination.

> E. 47. The Woburn City Council commented that: "EPA has not fully explained whether or not there are current/ongoing releases of COC'S into the Aberjona Watershed, particularly from points north, and if so, does the plan attempt to arrest the migration of such contaminants? Our understanding of the plan is that it principally reduces exposure to COC's and does not necessarily stop migration of COC's at the source or sources."

EPA Response: The March 2005 MSGRP RI, the June 2005 MSGRP FS and Proposed Plan, and the selected remedy clearly state that there are current ongoing releases of contaminants into the environment that are originating from the Industri-plex site. These contaminants are impacting groundwater that in turn discharge into the HBHA, which discharges into the Aberjona River. The RI/FS also identified unacceptable human health and ecological risks associated with these contaminants of concern (COCs). To reduce those risks, remedial action objectives (RAOs) were established as the cleanup goals for any future remedial action and also to serve as the guideline for developing remedial alternatives that would accomplish these goals. Following a comprehensive evaluation process, the selected remedy represents the best set of remedial alternatives to achieve the RAOs for all affected media while balancing all of the required evaluation criteria.

The principal source of groundwater contamination is contaminated soils at the Industri-plex site that could be as much as several million cubic yards in volume. It is not cost-feasible to remove these wastes as was determined during the OU-1 FS. EPA's selected remedy will intercept contaminated groundwater plumes and reduce their migration downstream. A remedial strategy to manage the migration of these contaminants and associated risks is more appropriate.

> E. 48. The Woburn City Council asked EPA whether any of the Preferred Alternatives, such as pond or plume intercept methods, inadvertently increase health risks by altering the migration of COC's onto currently "clean" properties within the City, and whether any of the Preferred Alternatives could actually interfere with the natural attenuation process that is currently occurring within the sediments of the pond and increase the downstream migration of contaminants.

EPA Response: EPA's selected remedy addresses the remedial action objectives and cleanup standards, as well as complies with all state and federal regulations. EPA's selected remedy will not cause the migration of COCs onto "clean" properties as suggested in the comment, but is expected to reduce the migration of contaminants of concern downstream and reduce health and environmental risks. Also, EPA's selected remedy utilizes and improves upon the treatment properties of the HBHA Pond.

E. 49. The Woburn City Council asked EPA for the specific proposed dredging methods and guidelines, and for assurances that the most careful methods of removing chemicals had been selected.

EPA Response: EPA's selected remedy addresses the remedial action objectives and cleanup standards, as well as complies with all state and federal regulations, including Section 404 of the Clean Water Act and the Executive Order for Floodplain Management, Exec. Order 11988 (1977), codified at 40 C.F.R. Part 6, App. A., 40 CFR 6.302(b). EPA's selected remedy includes sediment removal/dredging which will comply with all relevant and appropriate state and federal regulations. EPA's selected remedy envisioned hydraulic dredging for the deep sediments in the HBHA Pond and mechanical dredging for other sediments. The details of the sediment removal design will occur during remedial design. The Woburn City Council will have an opportunity to review and comment on specific design elements during the remedial design phase.

E. 50. The Woburn City Council asked EPA whether there has been or will there be any on-site study of the effectiveness of the proposed bioremediation for groundwater before full-scale treatment begins.

EPA Response: EPA believes that the selected bioremediation technology that was selected to address groundwater contamination at the West Hide Pile, if necessary, will be effective. As stated in the FS, a pre-design investigation will be conducted to develop the specific design details of the treatment application process as suggested.

E. 51. The consultant for the Woburn City Council commented that: "there may not be adequate protection for downstream receptors during the removal of the contaminated sediments from the HBHA pond. This concern primarily relates to the use of a hydraulic excavator, rather than a hydraulic dredge, to remove those sediments. Two possible site preparation methods (and the nebulous "other") are listed to help mitigate for sediment transport."

EPA Response: EPA's selected remedy includes sediment removal/dredging which will comply with all relevant and appropriate state and federal regulations. EPA's selected remedy anticipated hydraulic dredging for the deep sediments in the HBHA Pond and mechanical dredging or excavation for other near-shore sediments. The details of the sediment removal methods and protections will occur during remedial design. EPA's remedy will comply with all regulations and substantive permit requirements.

E. 52. The consultant for the Woburn City Council asked whether Alternative HBHA-4 will be effective in mitigating the mobilization of contaminants during storm and high water events.

EPA Response: A pre-design investigation will be conducted to evaluate storm water management concerns and provide a design basis for the final location and design components of the selected remedy. This design will be available to the City for review. At the northern portion of the HBHA Pond, the selected remedy will intercept contaminated groundwater plumes at the primary treatment cell, sequester/treat groundwater contamination at the primary and secondary treatment cells so that surface water effluent from the secondary treatment cell outlet achieves surface water cleanup standards. EPA believes that the selected remedy for the HBHA Pond will be effective at controlling the migration of contaminants above surface water cleanup standards downstream of the secondary treatment cell during base and storm flow events.

> E. 53. A resident of Wilmington commented that: "GW-1 (drinking water source areas) must be given the highest priority for cleanup. Better intervention is needed and should be updated for GW-1 to include only the newest and best technology available to identify and address the "actual break-down products and risks (contaminants imposed (forced on our environment) by the PRPs at possibly GW-2 or GW-3 locations if not at the source, or holding areas. Applying newer technologies along with "treatment trains" will further enhance removal."

EPA Response: The aquifer near the Industri-plex site within the Northern Study Area is not considered GW-1 by MassDEP. MassDEP's Use and Value Determination identified this area of the aquifer by Industri-plex to be of "low use and value."

> E. 54. A resident of Wilmington commented that: "[t]he most up-to-date technology should be made available and used to be most protective of public health and the environment where there is a complete exposure pathway."

EPA Response: EPA believes that the selected remedy utilizes appropriate technologies and addresses the remedial action objectives and cleanup standards. During the remedial design of the selected remedy, all appropriate technologies and methods to design the selected remedy will be evaluated for use at the Site.

> E. 55. SMC, Pharmacia and the consultant for SMC and Pharmacia commented that EPA's Proposed Remedy for the HBHA Pond will disrupt the natural ability of the pond to sequester arsenic.

EPA Response: The selected remedy for the HBHA Pond and its periodic dredging will not negatively impair the chemocline or increase downstream contaminant migration. See previous responses.

> E. 56. SMC commented that EPA's sediment remedy is needlessly invasive, and would create greater human health risk than capping and institutional controls.

EPA Response: The selected remedy for near shore sediments is more effective at reducing risk when compared with other alternatives is implementable, and its short-term effectiveness can be ensured through proper controls. EPA evaluated capping as an alternative in the FS, but it was eliminated from further consideration since in-situ caps may enhance accessibility to interior portions of the wetlands, which were previously considered inaccessible and typically have higher concentrations of contamination. In addition, capping would also require long-term inspections, maintenance, and institutional controls to ensure that the cap remained intact and protective and that the biological barriers mentioned in the comment remained effective in preventing access. Institutional controls would also be required where land use restrictions would be imposed and would require periodic inspection and enforcement to remain effective. All of these factors would also increase the cost of the capping alternative. Please also refer to EPA's responses to SMC's consultant's comments.

> E. 57. SMC commented that benzene beneath the West Hide Pile is attenuating naturally, and may be addressed adequately with existing institutional controls.

EPA Response: Benzene concentrations in groundwater remain elevated at the West Hide Pile, similar to concentrations previously detected in groundwater during the 1980s and 1990s. Also, elevated levels of benzene were detected in soils at the West Hide Pile (MSGRP RI). EPA conducted a baseline risk assessment based upon existing conditions that identified human health risks associated with potential future groundwater exposures to commercial/ industrial workers and excavation workers.

EPA's RI identifies that plumes associated with the West Hide Pile (e.g., benzene, arsenic, ammonia) likely discharge to nearby wetlands (e.g., southern pond). Insufficient groundwater data and no surface water data were available to assess the extent of the West Hide Piles groundwater plume's impact to surface water and sediments. Further pre-design investigation will be necessary for the area to evaluate West Hide Pile and East Hide Pile groundwater impacts on the near surface water and sediments and impacts to the downgradient plumes.

EPA's selected remedy is necessary to remove the high concentrations of benzene from the West Hide Pile. Institutional controls required under the 1986 Record of Decision have not been recorded on any property to date. If institutional controls are implemented that eliminate exposures, and predesign investigation do not identify these plumes contributing to human health risks and hazards or an ecological risk (exceeding the cleanup levels established for this remedy), then EPA agrees that implementation of Alternative GW-4 for the West Hide Pile may not be necessary.

> E. 58. SMC commented that the proposed remedy is overly costly.

EPA Response: EPA's selected remedy is estimated at $25.7 million, and does not represent the most expensive options that were evaluated under the Feasibility Study. The most expensive remedial alternatives could have exceeded a total cost of over $210 million as illustrated on Table 4-29 of the Proposed Plan, and Table K-8 of this ROD.

> E. 59. SMC and Pharmacia's consultant commented that: "USEPA has used the site-specific PRGs calculated in the FS as screening levels to identify locations that have a PRG exceedance, and thus areas that require additional action. Use of PRGs in this manner exaggerates the areas that may need to be addressed in the FS. The PRGs are EPC surrogates, just as the EPCs take into account the distribution of the data and ideally represent the 95% upper bound on the arithmetic mean concentration, so too should the PRGs."

EPA Response: The areas requiring remediation presented in the Feasibility Study were based on samples spaced approximately 50 to 75 feet apart and an estimation of areas exceeding the sediment PRG. Application of the sediment PRG in this manner was appropriate in developing a cost estimate to support the Feasibility Study within an expected accuracy of -30 percent to +50 percent based on the available data. However, as stated in the Feasibility Study, a pre-design investigation will be conducted to more closely delineate the extent of sediment contamination exceeding the sediment cleanup standards which requires remediation. The results of this investigation will serve as the basis of the Remedial Design.

> E. 60. SMC and Pharmacia's consultant commented that: "Wetland functions are being protected in the HBHA Pond under current conditions and would be also under USEPA's Proposed Plan. Therefore, wetland replication is not needed as part of any proposed remediation."

EPA Response: The sediments throughout the HBHA Pond were extremely toxic and are associated with contaminated groundwater discharges originating from the Industri-plex site. EPA's ecological risk assessment identified these sediments as presenting an unacceptable ecological risk to benthic organisms. Due to the sediment toxicity and surface water quality exceedances of the NRWQC, EPA does not concur that the wetland functions and values are being protected in the HBHA Pond under current conditions.

Due to sediment contaminant concentrations in both deep and shallow water and the periodic exceedances of the NRWQCs for arsenic and ammonia in surface water, the ability of the HBHA Pond to perform functions of providing wildlife habitat, fisheries habitat and pollution prevention are impaired. The selected remedy includes dredging contaminated sediments from the southern portion of HBHA Pond and restoring the impacted area. A compensatory wetland will be constructed to make up for any lost wetland functions and values in the northern portion of the pond and capped drainways. The lost functions and values of the southern portion will be restored in place. The degraded functions and values of the northern portion and capped drainways will be mitigated through the construction of compensatory wetlands nearby in the watershed. This mitigation will be consistent with ARARs.

The selected remedy incorporates the northern portion of the HBHA Pond into the treatment process, which periodically requires sediments to be removed. Considering these contaminated sediments and future accumulated contaminated sediments will be retained, impact benthic community, and periodically be removed from the northern portion, EPA's selected remedy identified the northern portion as a habitat loss requiring compensation through the construction of alternative habitat within the watershed. EPA's selected remedy for the southern portion of the HBHA Pond requires contaminated sediment removal and restoration. Hence, habitat compensation is not necessary for the southern portion.

> E. 61. SMC and Pharmacia's consultant commented that after a storm event, the chemocline is not broken down in the northern end of the pond, and that EPA's conclusions regarding the impact of storm events on the chemocline are based upon incomplete data.

EPA Response: EPA disagrees with the comment and the above analysis. EPA evaluated all the data associated with the HBHA Pond, not a limited data set as described by the commenter. EPA considered the nature and extent, fate and transport, and risks associated with all the data. Contrary to the comment, conductivity profiles collected throughout the water column by EPA indicate that during and following a storm event, the chemocline does destabilize. The HBHA Pond under baseflow conditions consistently illustrated that the depth of the chemocline throughout the pond ranged between approximately 150 centimeters (cm) to 250 cm below the surface of the pond. After a significant storm event, the chemocline was no longer observed at the central and southern stations. In addition, hourly surface water monitoring data collected from the most downstream surface water monitoring stations during the storm events revealed higher arsenic concentrations during first flush effects from upstream sources. This information correlates with storm water releases from the HBHA Pond.

> E. 62. SMC and Pharmacia's consultant commented that: "construction of a stormwater bypass and the Sediment Retention Cell, as proposed in USEPA's Proposed Plan, is not necessary to maintain the chemocline and associated arsenic removal processes."

EPA Response: The secondary treatment cell (referred by the commenter as a polishing cell) will further reduce contaminant concentrations (e.g., precipitate metals, degrade organics, volatilization) during baseflow and storm flow conditions, as well as address any potential episodic releases from the primary treatment cell. The secondary treatment cell will also further reduce ammonia concentrations associated with the contaminated groundwater plume discharge. The objective of the northern portion of the HBHA Pond, serving as a treatment component of the remedy (primary and secondary treatment cells), is to intercept contaminated groundwater plumes that discharge into the HBHA Pond at the primary treatment cell, sequester/treat contaminated groundwater plumes at the primary and secondary treatment cells, periodically remove the accumulated contaminated sediments from the primary and secondary treatment cells, and ensure that effluent from the secondary treatment cell outlet do not exceed surface water cleanup standards. .

> E. 63. SMC and Pharmacia's consultant commented that: "[s]ediments in the HBHA provide a second important arsenic removal process in the HBHA Pond. This process should be maintained and not disturbed by dredging."

EPA Response: The in-place sediments represent a partial arsenic sink for contaminated groundwater. However, EPA disagrees with the comment and reiterates that these sediments only remove a fraction of the arsenic as evidenced by the surface water data collected during the Natural Attenuation Study and the MSGRP investigations. Arsenic is continuing to migrate through the water column.

EPA's selected remedy for Northern Portion of the HBHA Pond (primary and secondary treatment cells) requires sediments that accumulate in the northern portion of the HBHA Pond to be removed periodically and disposed off-site. The selected remedy for the HBHA Pond takes into account that a portion of the sediments in the HBHA Pond help maintain the supply of ferrous iron that contributes to the capture of arsenic near the chemocline and promote microbial degradation, which suggests that when dredging becomes necessary in the primary treatment cell, only partial dredging should be implemented sufficient to lower the elevation of the chemocline and/or provide further sediment retention capacity. Also, dredging should only be implemented when necessary to ensure that the remedy is functioning appropriately, achieving the remedial action objectives and cleanup standards, and the chemocline remains below a depth of 100 cm in the water column ensuring no elevated releases of contaminants of concerns downstream.

EPA's selected remedy established the following conditions that may trigger dredging in the Northern Portion of the HBHA Pond (primary and/or secondary treatment cells): 1) if the chemocline rises to within 100 cm of the top of the primary treatment cell's low-head cofferdam (northern/first low-head cofferdam) outlet, or 2) concentrations of surface water effluent/outlet from the second treatment cell's low-head cofferdam (southern/second low-head cofferdam) exceed the surface water cleanup standards. However, EPA expects that other cost effective interim measures will be evaluated and possibly implemented prior to implementing dredging activities at the HBHA Pond. These interim steps (for example, actions other than dredging) may temporarily postpone the need for dredging operations, until the interim steps are no longer effective and excessive sediment accumulation within primary and/or secondary treatment cells requires dredging. Frequent long-term monitoring will be necessary to monitor the system.

The selected remedy for the Southern Portion of the HBHA Pond, which is not impacted by contaminated groundwater plume discharges, requires contaminated sediments be removed and the southern portion restored. In addition, EPA's selected remedy minimizes impacts to the HBHA Pond and maximizes the pond's restoration. EPA's selected remedy also requires the construction of compensatory wetlands to mitigate any wetland function and value losses.

The commenter appears to not understand the concept of the storm water bypass system. All of the storm water from Halls Brook will not be diverted from the northern portion of the HBHA Pond (primary and secondary treatment cells). Halls Brook is the predominant source providing steady inputs of low conductivity, oxygenated water, while contaminated groundwater plumes provide steady inputs of iron and sulfates. Hence, surface water baseflow conditions from Halls Brook will continue to flow into the primary treatment cell during storm events to sustain the chemocline. A portion of the storm water flows from Halls Brook which could potentially disrupt the chemocline will be diverted/by-passed to the southern portion of the HBHA Pond.

The purpose of the drainway liner is to prevent contaminated groundwater plumes from discharging to the drainway and contaminating sediments, which could migrate downstream and impact the selected remedy for HBHA Pond and contribute to further downstream migration during storm events. Surface water flow from the drainway will continue to flow into Halls Brook and the northern portion of the HBHA Pond. The drainway liner will not impact the functions of the selected remedy. Also, the primary source of iron to the HBHA Pond is from the discharge of contaminated groundwater plumes (not Halls Brook as the comment suggests).

> E. 64. SMC and Pharmacia's consultant commented that pond partitioning will adversely affect arsenic removal. In particular, the comment suggests that the selected remedy may significantly affect the settling capacity within the HBHA Pond.

EPA Response: The principal component associated with sequestering arsenic in the existing HBHA Pond are the chemocline, which is caused by groundwater plumes discharge to the pond and baseflow surface water discharge to the pond, the shape of the HBHA Pond, and its very shallow outlet elevation. EPA's selected remedy enhances these properties, and achieves the remedial action objectives. The selected remedy is expected to treat/sequester the contaminated groundwater plumes discharging into the HBHA Pond (including but not limited to arsenic, benzene and ammonia contamination), and reduce contamination migration downstream.

Groundwater discharge to the HBHA Pond, surface water discharge to the HBHA Pond, soil erosion, and contaminant fate and transport processes contribute to the distribution of the sediments in the HBHA Pond. EPA's selected remedy utilizes the northern portion of the HBHA Pond to intercept (via primary treatment cell) and sequester/treat groundwater plumes discharge to the pond (via primary and secondary treatment cells), and periodic removal of sediment (all sediment grains sizes, including fine grain) from the primary and secondary treatment cells . The comment points out the reduced settling area resulting from the installation of the low-head cofferdams but fails to acknowledge the reduced volume of water passing through the retention area during a storm event. Monitoring will be an important part of the design and remedy to ensure that the surface water cleanup standards are not exceeded. As noted in the FS and Proposed Plan and in previous responses, this portion of the selected remedy will also require further pre-design investigations.

The purpose of the primary treatment cell (northern/first low-head cofferdam), is to intercept contaminated groundwater plumes. The purpose of the primary and secondary treatment cells are to treat/sequester contaminants, retain sediments for periodical removal, and achieve surface water cleanup criteria (e.g., NRWQC) at the outlet of the secondary treatment cell. These contaminated groundwater discharges are occurring in the northern portion of the HBHA Pond. Investigations conducted as part of the MSGRP RI and acknowledged by the comment demonstrate that a portion of the contaminated sediments are transported to downstream areas due to "interim natural forces" (i.e., storm events). Halls Brook represents the largest contribution of storm flow to the HBHA Pond. Diverting the high flows associated with storm flows from Halls Brook away from areas where contaminated sediments are concentrated will reduce the downstream migration of these contaminants. The final design of the low-head cofferdams system will be developed following a pre-design investigation.

E. 65. SMC and Pharmacia's consultant commented that: "the arsenic mitigation strategy incorporated in the USEPA's Proposed Plan will likely be subject to periodic up-set and flushing via stormwater inflows from the Atlantic Avenue Drainway and the NSTAR ROW No. 9 drainage culvert. Similarly, re-suspended hydroxide floc transported to the Southern Basin will be flushed downstream by flows from the Halls Brook bypass. The intensity of these flushing flows will increase as development within the Pond's contributing drainage basin increases. Consequently, USEPA's Proposed Plan will remain susceptible to periodic flushing events and hence will continue to export sediment from the HBHA system . . . The new North Basin (Sediment Retention Cell) will be subjected to direct inflows from the Atlantic Avenue Drainway and the ephemeral stream draining NSTAR ROW No. 9. Collectively, these two inflow points drain approximately 45 percent of the area discharging to the Pond (MSGRP RI, 2005). During major storm events, runoff entering the basin from these sources will be significant and unmitigated. As evidenced by runoff hydrographs generated from the 5.31-inch precipitation event that occurred on March 22-24, 2001, peak inflows from the Atlantic Avenue Drainway approached 90 cubic feet per second (cfs), while the NSTAR ROW No. 9 culvert peaked at over 20 cfs (Roux Associates, 2002). The 5.31-inch event, while significant, corresponded to a design storm with a recurrent frequency of only 10 years (NCRS, 1986). Peak inflows from a 100-year event would be substantially greater. Ultimately, the flushing effects associated with large design storms would significantly and adversely affect the performance of the USEPA's Proposed Plan."

EPA Response: EPA disagrees with the comment. The flows from the identified tributaries during storm conditions were relatively minor compared with the storm flows from Halls Brook. Flows similar to these smaller storm flows have been experienced from the Halls Brook under baseflow conditions and no disruptions of the chemocline were observed. The data do not support the comment. EPA does not consider these tributary storm flows significant and does not believe they will disrupt the chemocline. As noted in the FS, Proposed Plan and this ROD, this portion of the selected remedy will also require further predesign investigations.

The comment is speculative in suggesting that: "The intensity of these flushing flows will increase as development within the Pond's contributing drainage basin increases." This suggests that future area development will go unchecked with regards to storm water management. Recent large-scale development in the immediate area of the Industri-plex site contradicts the comment's claim. In the case of the Anderson Regional Transportation Center, Target, and National Development's development of the northern Commerce Way extension and Presidential Way, significant storm water management structures have been incorporated into the construction design.

The comment is also speculative as far as predicting the failure of EPA's selected remedy, especially since the system has not yet been designed. As presented in the comment, the contributing flows of the Atlantic Avenue Drainway during the March 2001 storm event discussed in the comment are misleading in that the duration of the peak flow (90 cfs) was not presented nor was it discussed how the data was collected. This specific measurement was not presented in the Downgradient Transport Draft Report prepared by Roux Associates, dated April 1, 2002. The flow measurement presented in the report for this station on March 22, 2001 only showed a flow of 37.86 cfs. Again, this was a snapshot of the flow and the duration was not presented. However, it does illustrate the variability of flows during a storm event. As stated in a response to previous comments, the final design of the low-head cofferdams system will be developed following a pre-design investigation which will identify major design components of the cofferdams and storm water bypass system that are important to maximize its sediment retention capabilities.

E. 66. SMC and Pharmacia's consultant commented that: "[a]rsenic-containing iron hydroxide floc will form when reduced water in the bottom of the Sediment Retention Cell encounters the oxic/anoxic transition zone. Hydrous ferric oxides will form at the oxic/anoxic transition zone as reduced ferrous (Fe+2) iron encounters oxygenated water, oxidizes to ferric Fe+3) iron and precipitates as hydrous ferric oxide (HFO) floc (Skousen and Ziemkiewicz, 1995). Arsenic sorbs to the HFO floc, which would accumulate in the bottom of the Sediment Retention Cell.

Flushing flows into the Sediment Retention Cell from the Atlantic Avenue Drainway (90 cfs) and the ephemeral stream draining NSTAR ROW No. 9 (20 cfs) during major storm events would likely disrupt the chemocline and flush arsenic-bearing HFO floc to downgradient locations. The shortened length to width ratios created by the partitioning Coffer dams and the bypass of Halls Brook would significantly reduce TSS settling efficiency in the Southern Basin thereby increasing the export of the low density floc materials to downstream locations. The length to width ratios will shorten the amount of time and distance fine grained sediments will have to effectively settle out of the water columns. Similarly, the loss of the Northern pond area to Halls Brook inflows during stormwater runoff periods will eliminate the hydraulic buffering capacity, shorten available sediment settling time and convey higher sediment loads directly to the pond outlet from a re-directed Halls Brook (i.e., the by –pass option).

Perhaps more importantly, storms of lesser intensity occurring immediately after spring and fall turnover would export the re-entrained floc to the South Basin and similarly transport the arsenic bearing TSS downstream via the mechanisms discussed above. Turnover occurs in lakes and ponds deep enough to thermally stratify. In essence, as water cools in the fall, density differentials in the water column cause the cooler surface water to sink displacing warmer bottom water. This "turnover effect" results in a completely mixed water column that reintroduces low-density sediments present in the bottom of the Pond uniformly throughout the water column. The water will thermally re-stratify during the colder winter periods. During late winter ice-out conditions, the surface water warms to maximum density (i.e. 4oC), subsequently sinks to the bottom resulting in a spring turnover event. Similar complete water column mixing occurs until thermal stratification is re-established and water column stability returns (Wetzel, 1975, Tchobanogious and Schroeder, 1987). Even in the event that some of this material is re-deposited in the South Basin, it would be subject to re-entrainment and flushing during storm events via the high velocity inflows from the Halls Brook bypass option."

EPA Response: The comment suggests that the chemocline in the primary treatment cell and the sediment retention areas within the primary and secondary treatment cells of the northern portion of the HBHA Pond will be ineffective during spring and fall turnover periods even though no site-specific data are presented to support this claim. EPA has evaluated a significant amount of surface water data collected during various seasons from the HBHA Pond. EPA has not observed any turn-over conditions that would impact the performance of the chemocline such that the remedial action objectives as stated in the FS, Proposed Plan and this ROD would not be achieved. Increases in arsenic concentrations migrating from the HBHA Pond have consistently been shown to correlate with storm events.

Also, see above comment regarding tributary storm water flows. As noted in the FS, Proposed Plan, and this ROD, this portion of the selected remedy will also require further pre-design investigations. The actual size and location of the low-head cofferdams, which determines the size and location of the selected remedy for the northern portion of the HBHA Pond (primary and secondary treatment cells), will be determined during pre-design and design.

> E. 67. SMC and Pharmacia's consultant commented that a: "significant flaw in USEPA's Proposed Plan is the loss of future iron-rich sediment delivery to the proposed North Basin (Sediment Retention Cell). The elimination of the continuous supply of iron-rich organic materials from Halls Brook inflows during storm events could adversely impact the arsenic sequestration and attenuation processes in the Sediment Retention Cell . . .
>
> Another negative effect of the proposed Halls Brook stormwater bypass would be the elimination of a continuously oxygenated water supply to the proposed Sediment Retention Basin. As the sole perennial stream entering the Pond, Halls Brook is the major source of dissolved oxygen delivery to the water body. Given the importance of maintaining aerobic conditions in the Sediment Retention Cell for arsenic removal, the proposed bypass of stormwater inflows to the southern basin of the Pond could significantly effect the long-term maintenance of aerobic conditions within the proposed basin. Ultimately, this could result in the periodic development of anaerobic conditions within the basin and significantly effect arsenic removal performance."
>
> Pharmacia commented that partitioning the HBHA will reduce the pond's arsenic reduction potential.

EPA Response: EPA disagrees with these comments. The commenters misunderstand the conceptual design of the storm water bypass discussed in the Proposed Plan. EPA's selected remedy only diverts a portion of storm water flows from Halls Brook away from the northern portion of the HBHA Pond. It does not divert Halls Brook base flow component of surface water, which is an essential part of creating and maintaining the chemocline within the primary treatment cell. Only a portion of the storm water flows from Halls Brook, which could potential disrupt the chemoline, will be diverted downstream of the secondary treatment cell. As noted above, EPA will not be eliminating iron-rich organic materials. Contaminated groundwater, the primary source of iron in the HBHA Pond, will continue to discharge in the northern portion of the HBHA Pond. In addition, baseflow surface water discharge, as well as a portion of the storm water flows, will continue to contribute iron-rich sediments and dissolved iron.

> E. 68. SMC and Pharmacia's consultant commented that: "while dredging can remove sediment mass, it is not necessarily an effective technology when it comes to risk reduction; in fact, at a number of sediment sites, dredging has resulted in higher concentrations of the constituent of concern in surface sediments after implementation. As a result, the risks are increased as opposed to decreased."

EPA Response: EPA has successfully implemented sediment dredging at many Superfund sites. The success of the dredging project in minimizing sediment resuspension, migration, and downstream migration is dependent upon the dredging method selected and other engineering controls installed during dredging (e.g., silt curtains). For the FS, EPA assumed that hydraulic dredging methods would be used since this particular method is best suited for low-specific gravity sediments in the HBHA Pond and minimizes sediment resuspension in the pond during dredging. Details of the dredging will be refined during the design process. All dredging requirements will comply with all applicable state and federal regulations.

> E. 69. SMC and Pharmacia's consultant commented that: "although one of USEPA's goals of Alternative HBHA-4 is to provide an improved benthic habitat in a portion of the pond, dredging, no matter how effective, will never contribute to this end. The HBHA Pond is a man-made structure designed to retain stormwater, and its bottom is prone to anoxic conditions. Even if all the arsenic-containing sediments were removed, anoxia would likely continue, preventing the development of thriving communities."

EPA Response: The dimensions of the HBHA Pond do not cause the atypical anoxic conditions present at the deep surface water of the HBHA Pond. Contaminated groundwater plumes that discharge into the HBHA Pond cause the chemocline and severe contamination in the sediments and surface water of the HBHA Pond, as well as the high conductivity, anoxic and reducing conditions in the deep surface water of the HBHA Pond. The selected remedy will remove the discharge of contaminated groundwater plumes from the southern portion of the HBHA Pond, and EPA believes the sediment remediation and restoration of the southern portion of HBHA Pond will improve and provide additional habitat for aquatic life (e.g., benthic community and fish). The remediation of the southern portion of the HBHA Pond will also reduce downstream migration of contamination.

> E. 70. SMC and Pharmacia's consultant commented that: "the primary transport mechanism assumed in the Feasibility Study (FS) is scouring of the arsenic containing sediment from the bottom of the pond and downstream migration of these sediments. This, however, is not the case. Rather, the sediments in the HBHA Pond sorb arsenic entrained in groundwater as the groundwater discharges to the surface water. Further, hundreds of years of sorptive capacity remain in the sediments. Dredging these sediments would actually destroy an effective, functioning arsenic removal mechanism. In addition, since surface water velocities in the pond are quite low (a result of the pond's design as a retention basin), sediments are not scoured and transported downstream with any regularity."
>
> Pharmacia commented that the HBHA is sequestering and preventing downstream migration of contaminants.

EPA Response: EPA refers the commenters to the March 2005 RI and June 2005 Surface Water Modeling Report which identify transport mechanisms along surface water and clearly associates downstream migration of contaminated sediments from the HBHA Pond to increased storm flows during storm events. EPA's selected remedy dredges and restores sediments from the southern portion of the HBHA Pond, while the northern portion serves to sequester/treat contaminated groundwater discharging in the northern portion. The selected remedy for the northern portion of the HBHA Pond (primary and secondary treatment cells) requires sediments to be periodically dredged.

> E. 71. SMC and Pharmacia's consultant commented that: EPA "significantly underestimated the volume of sediments that would be dredged from the southern portion

of HBHA Pond if its Proposed Plan is implemented. USEPA's 6,700 cubic yard estimate of sediment volume was derived by multiplying the areal extent of the HBHA Pond south of the proposed northern cofferdam (135,000 square feet) by an assumed average sediment thickness of 1.33 feet (roughly equivalent to the 41-centimeter average sediment thickness of the 1991 GSIP Phase 2 Remedial Investigation data set). During implementation of the Final GSIP Scope of Work (SOW) in 2001, sediment thickness was measured at 22 locations throughout the HBHA Pond. Using this sediment thickness data, the portion of HBHA Pond to be dredged under USEPA's Proposed Plan contains approximately 10,000 cubic yards of sediments, almost 50 percent more than the sediment volume (6,700 cubic yards) used in the Proposed Plan to determine the costs for performance of this remedial action. Since sediment removal costs constitute a substantial proportion of the total capital costs for the HBHA Pond remedial action, USEPA significantly underestimated the cost of implementing its Proposed Plan."

EPA Response: EPA utilized reasonable information to estimate the volume of sediments requiring removal. The actual volume of sediments may increase or decrease depending upon actual field conditions at the time of implementation. When developing the FS estimate, EPA considered several sources of information including the Final GSIP data referenced in the comment, and applied sediment core data from Robert Ford's September 2004 Natural Attenuation Study (Appendix 2D of the March 2005 MSGRP RI), which was considered to be the most reliable data set to estimate sediment volumes.

The methods employed to measure sediment thickness in the HBHA Pond during the Final GSIP performed by the Industri-plex Site Remedial Trust (i.e. pushing a perforated disk through the water column and "feeling" the differences in resistance between the water and sediment) were subjective with considerable uncertainty. No confirmation cores were collected to verify the accuracy of this method.

E. 72. SMC and Pharmacia's consultant commented that: the "Wells G & H Wetland near shore sediments targeted for remediation are not easily accessible. The existing dense vegetation and adjoining rifle range make this wetland both difficult and potentially dangerous to access. Existing potential physical hazards pose far greater impediments to accessing deeper areas within the Wells G & H Wetland than potential access facilitated by above-grade *in situ* capping."

EPA Response: EPA disagrees with the comment and considers the identified near shore sediment areas to be accessible.

E. 73. SMC and Pharmacia's consultant commented that "caps can be designed to provide dermal barriers to exposure without excessive thickness (e.g., incorporation of geotextiles). Because the proposed remedial areas are relatively confined, caps placed over wetland sediments would likely settle, keeping increases to the existing grade elevation to a minimum.

. . . USEPA's concerns regarding potential access to deeper sediments as a result of capping could be effectively addressed through use of additional biological barriers to supplement the existing dense vegetation (i.e., planting vegetation containing briars/thorns while avoiding those that produce edible fruits [e.g., blackberry])."

EPA Response: The selected remedy for near shore sediments is more effective at reducing risk when compared with other alternatives. EPA evaluated capping as an alternative in the FS, but it was eliminated from further consideration since in-situ caps may enhance accessibility to interior portions of the wetlands, which were previously considered inaccessible and typically have higher concentrations of contamination. In addition, capping would also require long-term inspections, maintenance, and institutional controls to ensure that the cap remained intact and protective and that the biological barriers mentioned in the comment remained effective in preventing access. Institutional controls would also be required where land use restrictions would be imposed and would require periodic inspection and enforcement to remain effective. All of these factors would also increase the cost of the capping alternative.

E. 74. SMC and Pharmacia's consultant commented that future human exposures to groundwater at the West Hide Pile can be prevented or controlled through the use of institutional controls. In addition, SMC and Pharmacia's consultant commented that: "[g]iven the absence of any chemical-specific ARARs for Site groundwater . . . or any other regulatory driver for groundwater cleanup at the West Hide Pile, ...there was no need for USEPA to include enhanced in-situ bioremediation for the West Hide Pile in its Proposed Plan."

EPA Response: Benzene concentrations in groundwater remain elevated at the West Hide Pile, similar to concentrations previously detected in groundwater. EPA conducted a baseline risk assessment based upon existing conditions resulting in the identification of human health risks associated with potential future groundwater exposures to commercial/ industrial workers.

EPA's selected remedy is necessary to remove the high concentrations of benzene from the West Hide Pile. Predesign investigations will be necessary to further evaluate the West Hide Pile and East Hide Pile contaminated groundwater plumes impact on the nearby wetlands and downgradient groundwater plumes. Institutional controls required under the 1986 Record of Decision have not been recorded on any property to date. If institutional controls that eliminate human health risks are implemented and maintained, and predesign investigation do not identify these plumes contributing to human health risks and hazards or an ecological risk (exceeding the cleanup standards established for this remedy), then EPA agrees that implementation of Alternative GW-4 for the West Hide Pile may not be necessary.

E. 75. SMC and Pharmacia's consultant commented that: "further reductions in the concentration of benzene in West Hide Pile groundwater will likely require the injection of oxygen in quantities designed to cause the complete degradation of the soluble organic carbon from the hides. Consequently, enhanced *in-situ* bioremediation cannot feasibly be implemented to treat benzene in groundwater at the West Hide Pile as proposed in USEPA's Proposed Plan is technically infeasible."

EPA Response: Injection of oxygen enriching compounds will stimulate biodegradation of organic compounds such as benzene. A pre-design investigation will be required to define the target area of application and the specific oxygen formula composition and application rates. In addition, with regards to arsenic, application of this technology may have a secondary benefit in that injection of oxygen-releasing compounds may actually reverse the reducing conditions at the hide pile that are driving the mobilization and migration of arsenic.

> E. 76. The ASC consultant commented that: "• In designing the cofferdam system EPA should carefully consider likely changes (*e.g.*, due to inputs of salts to the hypolimnion, seasonal effects, and large storms) in the physical and chemical constraints that govern the reactions that are hoped will occur in the north basin (i.e., nitrification, oxidation of arsenic and sorption onto ferric iron, biodegradation of benzene). • EPA should consider adopting concentration-based standards for contaminants of concern in waters discharging from the cofferdams. In setting the standards, EPA should mandate both regular and event monitoring to capture the range of anticipated flow conditions and pollutant discharges. • EPA should also answer the following questions regarding the treatment system and cofferdam/aeration system. • How long will it take for the treatment system to achieve the ammonia PRG of 4 mg/L in groundwater entering the north basin? • What is the design life of the cofferdam and aeration system? • If the PRGs for arsenic and benzene are achieved before that of ammonia, will the treatment system be maintained and operated until the ammonia PRG is achieved?

EPA Response: Predesign investigations will be implemented to determine the design of northern portion of the HBHA Pond (primary and secondary treatment cells, storm water by-pass system, etc). The outlet of the northern portion of the HBHA Pond (secondary treatment cell effluent) will serve as the surface water compliance boundary and must achieve surface water cleanup standards. Due to waste remaining in place at the Industri-plex site (e.g. animal hide wastes), cleanup standards for ammonia in groundwater are not expected to be achieved for the foreseeable future. The selected remedy will be required as long as there are exceedances of the cleanup standards.

F. Questions and Comments Concerning Scope of the Feasibility Study

> F. 1. A resident of Wilmington commented that while Olin Chemical is mentioned, the report does not include source discharges to Halls Brook from Olin Chemical Industry/Wilmington under EPA NPDES permits.

EPA Response: Sediment data collected from the East Drainage Ditch and the New Boston Street Drainway were presented in the 2005 MSGRP RI. In addition surface water data from the East Drainage Ditch and the New Boston Street Drainway were presented in the October 2005 Technical Memorandum – Evaluation of Ammonia and Supplemental Soil Data Report.

> F. 2. A resident of Wilmington asked whether there were any NPDES discharge permits to Halls Brook or the Study Area not mentioned in the FS.

EPA Response: Information regarding current NPDES permits was presented in the 2005 MSGRP RI.

F. 3. A resident of Wilmington asked where Woburn's current town drinking-water sources are in relation to the study area, whether there is there any possible impact to the drinking water sources, and whether the best technology has been employed to protect the sources beyond drinking water standards.

EPA Response: Drinking water sources for Woburn were identified in the 2005 MSGRP RI. Currently, Woburn obtains its drinking water from two sources 1) Horn Pond aquifer located in West Woburn, and 2) Quabbin Reservoir located in Central Massachusetts and provided by Massachusetts Water Resource Authority. The Horn Pond aquifer is situated west of the study area in West Woburn. As presented in the MSGRP RI and FS, EPA does not believe that contamination addressed under Industri-plex OU-2 impacts any of Woburn's current drinking water sources.

F. 4. A resident of Wilmington asked whether there is a listing of any and all private wells within the Study Area and whether receptors within 5001 (or other required footage) were notified and updated on the conditions. Ms. Duggan also commented that if private well owners were not notified, they should be and receive assistance as part of the process.

EPA Response: Private wells in the vicinity of the Industri-plex Site were identified in the 2005 MSGRP RI. There are no private wells currently located within the groundwater plume areas requiring remediation.

F. 5. The MBTA asked EPA to provide the report reference that indicates the depth to groundwater and location of contaminated surface water (if any) within the MBTA ROW.

EPA Response: Monitoring wells installed within the MBTA ROW are identified on Figure 2-4 of the RI. The depths to groundwater observed during sample collection are presented in Appendix 2 of the RI, and elevations are presented in Appendix 3A of the RI.

The comment is somewhat vague in requesting the location of "contaminated surface water". All surface water in the HBHA has some degree of contamination. However, surface water did not present an unacceptable human heath risk for the exposure scenarios evaluated for the contaminants of concern. Please refer to Section 6.0 of the RI for a more thorough discussion of human health risks.

F. 6. One commenter stated that Kraft Foods has applied to increase the amount of water they are permitted to pump from Walkers Pond a/k/a Whittemore Pond on Montvale Avenue, and asked EPA whether or not an increase in pumping could draw contaminants into the pond or into their plant.

EPA Response: EPA is unaware of any contamination issue at Whittemore Pond that may present water quality issues for Kraft Foods. The commenter's letter does not specify how much more water Kraft is intending on withdrawing from wells located near the pond in addition to the approximate 200,000 gallons per day that they are currently permitted.

The MSGRP RI investigations did not extend to the area of Whittemore Pond, but was concentrated along the Aberjona River. The impacts of additional withdrawals on the pond are unknown. EPA is unaware of any geochemical or hydrogeologic information presently available for the area between the Aberjona River and Whittemore Pond. However, based on the evaluation of data from the Wells G&H wetland and their potential impact under a drinking water withdrawal (see Appendix 5A of the RI), EPA does not believe that dissolved arsenic present in surface water of the Aberjona River will impact Whittemore Pond. EPA suggests however, that if these additional withdrawals are of concern, the City should request that Kraft Foods conduct a hydrogeologic investigation that models the impacts of the proposed withdrawal increases, specifically with regard to seasonal pond elevations.

F. 7. The consultant for the City Council commented that: "[w]e were unable to determine if a site specific treatability study was performed using the proposed oxygenates (which were not detailed) to determine if this treatment method would be applicable for this site. Since there are many factors that influence in-situ oxidation, a careful evaluation of the site-specific parameters and the extent of contamination is crucial to the proper application and success of this remedial technology. There is a need to understand the interaction between native soil and oxidants, determine soil oxidant demand (SOD), and to determine efficacy of oxidants on target compounds. Conducting this study and analyzing and subsequently reporting the data could go a long way to determine if this proposed remediation method will be effective.

EPA Response: EPA believes that this technology will be effective at this site. As stated in the FS, a pre-design investigation will be conducted to develop the specific design details of the treatment application process as suggested.

F. 8. EPA received a telephone message from Ms. Theresa Murphy, Woburn Conservation Commission. Ms. Murphy understands that EPA has identified contamination in the Aberjona River, and asked the following question: She was informed that a business in Woburn may be withdrawing surface water from the Aberjona River for use in its commercial products such as hydro-seeding mixtures. If surface water were being withdrawn from the river, then what would EPA's position be on the matter, and does it violate any federal laws?

EPA Response: EPA is unaware of any federal laws that would prohibit the withdrawal of surface water in the estimated quantities stated. The Massachusetts Water Management Act (Act) requires a permit for surface water withdrawals over 100,000 gallons per day. The Act does give MassDEP the authority to regulate withdrawals below 100,000 gallon per day, but MassDEP has not yet exercised this authority.

F. 9. MBTA expressed a concern regarding the nature and extent of ammonia contamination in groundwater west of the Lower South Pond and north of the intersection of Merrimac and New Boston Streets: "It does not appear that the EPA characterized soil and groundwater in this area. Due to the likely presence if high ammonia concentrations in this area, which is located west of three hide piles (hide piles are the known source of ammonia), our comments/concerns are as follows:

- The EPA should collect additional ammonia data in this area."

MBTA further stated that:
"The chosen remedial measure by the EPA should take into account the depth of the hide piles, which was reported to be over 40 feet deep in areas."

EPA Response: EPA did collect three groundwater samples for ammonia analysis in the vicinity of the area identified in the comment. Soil sampling was not required since the soils in this area were addressed under OU-1. Other groundwater samples analyzed for ammonia were collected west and southwest of the East Central Hide Pile and South Hide Pile. The ammonia sampling was sufficient to address site risks related to ammonia contaminated groundwater. EPA has included the subject area within the boundaries of Industri-plex OU-2. It should be noted that the concentrations of ammonia exceeding the ammonia PRG were found to be within the limits of the arsenic/benzene plume (see Figure 2-4, June 2005 Feasibility Study) that will also be addressed under Alternative GW-2. Also, as stated in the MSGRP RI and the FS, EPA did consider the depth of the buried wastes at the hide piles and the impacts on the fate and transport of contaminants in soil and groundwater. Remedial measures for these buried wastes have already been completed under OU-1.

F. 10. The Custodial Trust asked:

"1) Do you know why no elevated ammonia shows up around the West and East Hide Piles?

2) And, did EPA look at the most recent work being done at Tufts regarding ammonia?"

EPA Response: Samples for ammonia analysis were collected near the West Hide Pile at groundwater sampling location A01 and A02 (see Appendix A, October 2005 Draft Final Technical Memorandum – Evaluation of Ammonia and Supplemental Soil Data Report). Ammonia concentrations of 63.7 mg/L and 79.3 mg/L were detected at A01 and A02, respectively. Also, EPA did review the Tufts MS thesis prepared by M. Cutrofello (Tufts).

F. 11. The concerned Citizens Network expressed an interest that the scope of the source investigation for the Industri-plex RI should extend to the Olin Chemical site in Wilmington, MA: "The ammonia contamination on the Olin site and the site's contamination migratory pathway into the Aberjona watershed, are both well documented. In our opinion it is more than reasonable to investigate this site as a potential source contributor of the high ammonia levels found in the northern areas of the Industrial-Plex (sic)."

Other comments also expressed extending/ expanding investigations to Olin Chemical, as well as the Woburn Landfill, relative to their potential contribution of ammonia.

EPA Response: Sediment data collected from the East Drainage Ditch and the New Boston Street Drainway were presented in the 2005 MSGRP RI. In addition surface water data from the East Drainage Ditch and the New Boston Street Drainway were presented in the October 2005 Draft Final Technical Memorandum – Evaluation of Ammonia and Supplemental Soil Data Report. Concentrations of ammonia were detected in these streams. Further pre-design investigations will be implemented to evaluate the background concentrations of ammonia. Please be advised that the Olin Chemical facility was proposed on EPA's National Priority List (NPL) on September 14, 2005, and will be the subject of a separate Remedial Investigation. Olin's contribution to groundwater contamination will be addressed as part of the investigations at the Olin facility.

F. 12. National Development's consultant stated that they believe the interpreted groundwater plume requiring remediation does not extend onto MetroNorth Business Center's property. "According to Figure 2-4 of the Report, four monitoring wells were installed within the MNBC property, or on the northern border of the MNBC property - B7-02, B7-04, B7-05, and B7-07. Well B7-02 is in the tail area; the other wells are on the main portion of the property or at the northern border of the property. Only one of these wells B7-02, at the tail of the property, is included among the monitoring wells with contaminant concentrations that pose future human health risk."

EPA Response: Based upon available data and hydrogeology, EPA maintains that contaminated groundwater exceeding the groundwater cleanup standards for arsenic, benzene, naphthalene, etc., does extend onto the subject property and will require remediation in accordance with the selected remedy (i.e. GW-2 Institutional Controls). Monitoring well locations on the property, immediately upgradient of the property (including B7-03), and immediately downgradient of the property all exhibit concentrations exceeding the groundwater cleanup standards. As presented in the MSGRP RI, groundwater flows in a general south to southwesterly direction. These concentrations and aquifer hydrological conditions were modeled to determine the boundaries of the groundwater plumes. Further pre-design investigations may be implemented to determine the extent of groundwater institutional controls.

F. 13. The consultant for ASC commented that: "Conversion of ammonia to gaseous nitrogen is not likely to occur at significant rates and EPA's conjecture that it may occur is misleading and unsupported." ASC includes a specific quote from the October 2005 Draft Final Technical Memorandum – Evaluation of Ammonia and Supplemental Soil Data Report, describing the fate and transport of the ammonia in surface water.

EPA Response: EPA's discussion of the fate and transport of ammonia presented in the Technical Memorandum – Evaluation of Ammonia and Supplemental Soil Data – October 2005, does not suggest or imply that all ammonia is converted to nitrogen gas. The discussion presents the fate and transport processes affecting ammonia which are part of the nitrogen cycle, and includes the conversion of some ammonia to nitrogen gas, thus "completing the nitrogen cycle". The fate and transport discussion recognizes that the nitrogen cycle may be incomplete for some of the ammonia within the HBHA.

Specifically, the technical memorandum states, "As ammonia migrates to the chemocline, aerobic bacteria can convert the ammonia to nitrite. Through diffusion, the nitrite comes into contact with the more oxygenated zone of the chemocline where it can be further oxidized to nitrate. Further reductions can also occur through facultative anaerobic bacteria where the nitrate can be reduced to nitrite and nitrogen gas can be released."

> F. 14. The consultant for ASC indicated that the groundwater data was insufficient to contour ammonia plumes. Specifically, the consultant commented that: "EPA did not collect sufficient data to assess ammonia transport, and the available groundwater data are not sufficient to justify contouring."

EPA Response: EPA did not present an ammonia contour map as suggested in the comment. Figure 3-1 presents groundwater sample locations that were sampled for ammonia and presents the results of the sample analyses at each of those locations. The contour line that is shown on Figure 3-1 represents the approximate boundary of the contaminated groundwater plume area that would be addressed by the preferred alternatives presented in the Proposed Plan, as indicated in the figure legend. As highlighted in Figure 3-1, monitoring wells containing concentrations of ammonia above 4 mg/L were situated within the contaminated groundwater plume area. The ammonia data was sufficient to understand the nature and extent of significant ammonia concentrations, fate and transport processes, and address site groundwater risks. As outlined in the October 2005 Draft Final Technical Memorandum – Evaluation of Ammonia and Supplemental Soil Data Report, 1) ammonia concentrations are greatest closer to areas with buried animal hides (e.g. hide piles); 2) buried animal hides present a significant source of organic nitrogen; 3) site-wide reducing conditions in groundwater favor the production and mobilization of ammonia in groundwater; and 4) based on the site hydrogeology, ammonia in groundwater would follow the same migration pathways as other site groundwater contaminants previously documented.

> F. 15. The consultant for ASC commented that: "EPA should consider the requirements of the Clean Water Act as Applicable or Relevant and Appropriate Requirements (ARARs) and should demonstrate that the proposed plan complies. As required by the Clean Water Act, EPA should perform an assessment of nitrogen loading to the Aberjona River including contamination from the Industri-plex and Wells G&H Superfund sites."

EPA Response: EPA conducted a baseline risk assessment and identified various compounds contributing to unacceptable human health and/or ecological risks in groundwater, surface water, sediments and soils. At the Industri-plex site, contaminated groundwater discharges into the HBHA Pond causing elevated levels of arsenic, ammonia and benzene in surface water above surface water cleanup standards. The selected remedy for HBHA Pond will adequately address the unacceptable risks posed by these compounds, and prevent the downstream migration of these compounds from the northern portion of the HBHA Pond above the surface water cleanup standards, which are based on the freshwater chronic (CCC) NRWQC and consistent with the Massachusetts Water Quality Standards. The Commonwealth of Massachusetts, will continue assessing the Aberjona River and other rivers within the Commonwealth, and will develop a total mximum daily load (TMDL) for certain pollutants in the Aberjona. Any TMDLs will be considered in the five-year review process. EPA will require implementation of a comprehensive monitoring program to evaluate the effectiveness and protectiveness of the selected remedy. The details of the monitoring program will be developed during the remedial design phase.

G. Questions and Comments Concerning Monitoring and Ongoing Review of the Remedy

G. 1. The Woburn City Council asked EPA how frequently clean-up methods will be re-evaluated, and how frequently and in what format will EPA communicate with the public and public officials about the efficacy of the methods. The consultant for the ASC also commented that "EPA should consider mandating that contingency plans be developed in the event that the cofferdam system does not meet the concentration-based standards."

EPA Response: A comprehensive review will be conducted at least every five years to evaluate the protectiveness of the remedy. The findings of the five-year review will be presented in a report which will be made available to the public and will be included in the Administrative Record. The purpose of the five-year review is to evaluate the implementation and performance of the remedy in order to determine if the remedy is or will be protective of human health and the environment. The five-year review will document recommendations and follow-up actions as necessary to ensure long-term protectiveness of the remedy or bring about protectiveness of a remedy that is not protective. These recommendations could include providing additional response actions, improving O&M activities, optimizing the remedy, enforcing access controls and institutional controls and conducting additional studies and investigations. For example, if under the selected remedy the NRWQC values cannot be achieved at the HBHA Pond compliance point, then additional actions may be required. If different remedial actions are necessary, then other remedial alternatives, such as GW-3 Plume Intercept by Groundwater Extraction, Treatment and Discharge and Monitoring with Institutional Controls coupled with HBHA-5 Removal and Off-Site Disposal, outlined in the June 2005 FS, may be considered.

G. 2. The consultant for the Woburn City Council commented that: "[s]ince there is a heavy reliance on institutional controls and some *in-situ* remediation activities rather than removal actions, we believe that it would be in the best interest to have annual reviews of the monitoring data generated with an accompanying public meeting."

EPA Response: The five-year review process is not the only process whereby the effectiveness of the proposed remedy will be evaluated. An EPA-approved comprehensive monitoring program will be developed during remedial design and instituted as part of the selected remedy. This EPA-approved monitoring program will be performed consistent with previous RI monitoring methods and procedures so that on-site and off-site contaminant trends and migration patterns can be adequately evaluated and compared to previous RI data. Monitoring will also be performed to evaluate the performance of the selected remedy. Specific details of the monitoring program will be developed during the remedial design process. The results of the monitoring program will be made available to the public.

G. 3. The consultant for SMC and Pharmacia commented that: "During the feasibility study process, long-term monitoring evolved from a multi-medium approach to a medium-specific approach that is contrary to the USEPA's own Conceptual Site Model approach and framework for monitoring plan development, and is not integrated to the extent warranted by the interdependent nature of the preferred remedial alternatives; and [t]his medium-specific approach results in an inappropriately extensive sampling program."

EPA Response: EPA identifies monitoring as a necessary component of the selected remedy. The monitoring program described in the Proposed Plan is the result of combining individual alternatives from the FS, which presented monitoring programs specific to the medium and remedial alternative selected. EPA recognizes that monitoring efficiencies can be realized when a multi-medium approach is taken. An EPA-approved monitoring program will be performed consistent with previous RI monitoring methods and procedures so that on-site and off-site contaminant trends and migrations patterns can be adequately evaluated and compared to previous RI data. Monitoring will also be performed to evaluate the performance of the selected remedy. Specific details of the monitoring program will be developed during the remedial design process.

G. 4. The consultant for SMC and Pharmacia commented that: "The objective of long-term monitoring for the Site is to monitor the effectiveness and protectiveness of the proposed remedial actions. However, due to the non-integrated nature of the long-term monitoring program proposed by USEPA, most of the data generated can not be used to meet this objective. For example, groundwater and surface water data will be developed for many areas of the Site where changes in contaminant concentrations will have little or no impact on the effectiveness or protectiveness of the proposed remedial actions, since there are no current risks in these areas and potential future risks will be managed by institutional controls. Also, some of the analytical parameters (e.g., semivolatile organic compounds) are proposed for media and locations where they don't exist or where their presence has little or no effect on overall Site risks. Lastly, sampling frequencies proposed in the various medium-specific long-term monitoring plans, which range from quarterly to semi-annually, are also inappropriate.

Typically, quarterly or semi-annual sampling is performed to identify seasonal trends, such as fluctuations in contaminant concentrations associated with higher or lower water levels. However, seasonal monitoring is clearly not needed for the duration of long-term monitoring."

EPA Response: An EPA-approved monitoring program will be performed consistent with previous RI monitoring methods and procedures so that on-site and off-site contaminant trends and migrations patterns can be adequately evaluated and compared to previous RI data. Monitoring will also be performed to evaluate the performance of the selected remedy. Specific details of the monitoring program will be developed during the remedial design process.

G. 5. The MBTA commented that: "The EPA should require that post-remediation monitoring for ammonia be conducted, to ensure that levels are maintained within acceptable limits."

EPA Response: Ammonia is a contaminant of concern that will be monitored to ensure compliance with the cleanup standards.

G. 6. The consultant for DEK commented that the proposed pre-design investigations/studies and long-term monitoring should also consider the ammonia by-products from the selected remedy for HBHA Pond.

EPA Response: The selected remedy addresses the unacceptable risks identified at the Industri-plex site. The details associated with long-term monitoring will be addressed during remedial design.

H. Questions and Comments Concerning Applicable or Relevant and Appropriate Requirements ("ARARs")

H. 1. SMC commented that: "EPA acknowledges that the subaqueous cap complies with all applicable ARARs more effectively than does the partial dredging remedy. *Id.* tbl. 4-28D; *see also* Proposed Plan tbl. 4-29. Unlike dredging, a Subaqueous Permeable Reactive cap complies completely with chemical-specific ARARs for the Pond, because the cap would ensure that the discharge of arsenic from the groundwater does not make its way into the surface water of the Pond. A Subaqueous Permeable Reactive cap, proposed in SMC's Alternative Remedial Action Plan, achieves complete compliance with identified ARARs, while the dredging remedy does not."

EPA Response: The comment states that the subaqueous cap alternative performs slightly better than the HBHA-4; Storm Water Bypass and Sediment retention with Partial Dredging and Providing and Alternate Habitat. As referenced in the comment, this is graphically shown on Table 4-29 of the Proposed Plan. However, this slightly better performance in complying with ARARs is based on the fact that, under the Subaqueous Cap scenario (Alternative HBHA-3), contaminated groundwater discharges are assumed to be completely eliminated through another groundwater alternative (e.g. GW-3 pump and treatment system). The remedy selected in this ROD does not include a pump and treat system. EPA does not believe that a subaqueous cap alone will be effective in eliminating contaminated groundwater discharges. HBHA-4 allows contaminated groundwater to discharge into a controlled northern part of the HBHA Pond sediment retention area (primary treatment area/cell) where natural processes decrease the arsenic concentrations in surface water. When the cost of a groundwater pump and treat system, along with measures needed to avoid recontamination, are taken into account, the partial dredging remedy is a more cost-effective means to achieve remedial action objectives, and it minimizes impacts to the aquatic environment.

EPA's Response to the Alternative Remedial Action Plan is contained in Section I, below.

H. 2. SMC commented that: "EPA's dredging will contravene an action-specific ARAR identified by EPA for the Pond, namely a Massachusetts water pollution control regulation, which states that 'No discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on aquatic ecosystem. . ."

EPA Response: See Response to Comment H. 1, above.

H. 3. SMC commented that the preferred alternative HBHA-4 may not be cost-effective "as required" by the Massachusetts Contingency Plan ("MCP"), Mass. Regs. Code 310, § 40.0860(7).

EPA Response: The cited provision of the MCP is not applicable or relevant and appropriate under CERCLA. EPA and MassDEP rely on the provision of the MCP that provides that "(t)he Department shall deem response actions at a disposal site subject to CERCLA adequately regulated for purposes of compliance with 310 CMR 40.0000, provided: (a) the Department concurs with the ROD and/or other EPA decisions for remedial actions at such site in accordance with 40 CFR 300.515(e)." Massachusetts has concurred with the ROD, and, therefore, the site is "adequately regulated" for purposes of state law.

H. 4. SMC commented that EPA's assumptions regarding exposure to near-shore sediments in the Wells G & H Wetland and Cranberry Bog Conservation Area is unrealistic, and stated that "EPA has dropped from its list of future areas of concern locations NT- 1 and NT-2, precisely because the City of Woburn has decided not to build a boardwalk in that location, . . .thus acknowledging implicitly the sufficiency of institutional controls. In fact, the City's Redevelopment Plan actually includes observation decks to *prevent* exposure to sediments, not facilitate it as EPA says."

SMC goes on to comment that institutional controls and monitoring would be sufficient to remedy the unacceptable risk in the Wells G & H Wetland and Cranberry Bog Wetlands, further stating that: "[t]o the extent a waiver of ARARs is necessary with respect to the near-shore sediments of the Wells G&H Wetlands and the Former Cranberry Bog, EPA may consider capping and institutional controls to be an "interim measure" as part of a "total remedial action" that will satisfy ARARs, 40 C.F.R. § 300.430(f)(1)(ii)(C)(1), or an alternative that will attain an "equivalent" standard of performance to that required under the ARARs, *id.* § 300.430(f)(1)(ii)(C)(4). EPA should also consider whether the drastic remedy of excavation and off-site removal of sediments, the scope of which is inadequately defined, see footnote 5, may pose a greater risk to human health than institutional controls and monitoring, thus warranting a waiver of ARARs under 40 C.F.R. § 300.430(f)(1)(ii)(C)(2). Under any of these provisions, a waiver of ARARs would be appropriate, to the extent a waiver is necessary."

EPA Response: The commenter's description of accessibility is overstated. EPA and MassDEP have had little trouble accessing the areas for sample collection and in fact have observed evidence of activity by others (trash, fire pits, etc.). Please also refer to previous responses regarding exposure scenarios.

If the City of Woburn recommends nature trail options NT-1 and NT-2, which constructs trails deeper into the wetlands, then those nature trail options will need to be considered in the remedy since the boardwalks would actually provide an avenue to more easily access areas deeper into the wetlands where contamination may present a human health risk.

No waiver of ARARs under 40 C.F.R. § 300.430(f)(1)(ii)(C)(2) is necessary. The selected remedy is more effective at reducing risk when compared with institutional controls and monitoring. The current volume estimate of sediments requiring removal may actually be overestimated since the proposed limits are bounded only by limited samples shown not to exceed the sediment cleanup standards. Pre-design investigation sampling could in fact more closely delineate the remediation area and reduce the overall area and volume of sediments requiring excavation.

> H. 5. SMC commented that: "[r]emedial option GW-4 is unnecessary to achieve compliance with ARARs for groundwater at the MSGRP Study Area. Remedial option GW-2, which combines a pond intercept mechanism with monitoring and institutional controls, already achieves compliance with ARARs, reduces the toxicity, mobility, and volume of contaminants, is less costly, and is significantly easier to implement than the in-situ groundwater treatment option. Proposed Plan tbl. 4-29. Moreover, injecting oxygen-rich compounds into the groundwater beneath the West Hide Pile is not likely to diminish the size of the benzene plume, because other organic compounds will compete for the oxygenated material, thus preventing the material from targeting the benzene effectively. This proposal is therefore not only unnecessary, but fails to recognize that it is technologically impracticable to devise a system that will diminish the benzene plume by injecting oxygen into the groundwater beneath the West Hide Pile. In fact, injecting oxidizing material will lock up the iron in the groundwater, even though iron is needed to make the Pond work as an arsenic sink. Although SMC does not believe that injecting oxygenated compounds into the benzene plume is necessary to satisfy ARARs not already met by GW-2, if EPA disagrees, it should waive ARARs pursuant to 40 C.F.R. § 300.430(f)(1)(ii)(C)(3)."

EPA Response: Both GW-2 and GW-4 comply with ARARs. However, implementation of GW-4 may also be necessary if the groundwater discharge from the West Hide Pile is having an unacceptable impact on surface water and sediments. EPA disagrees with the stated opinion that "injecting oxygen-rich compounds into the groundwater beneath the West Hide Pile is not likely to diminish the size of the benzene plume". Injection of oxygen-enriching compounds will stimulate biodegradation of organic compounds such as benzene. A pre-design investigation will be required to define the target area of application and the specific oxygen formula composition and application rates. Regarding arsenic, application of this technology may have a secondary benefit in that injection of oxygen-releasing compounds may actually reverse the reducing conditions at the hide pile that are driving the mobilization and migration of arsenic.

> H. 6. SMC commented that: "institutional controls and monitoring may be considered an 'interim measure' that, along with the natural attenuation of benzene beneath the West Hide Pile, will become part of 'total remedial action' that will meet ARARs. *Id.* §300.430(f)(1)(ii)(C)(1). Or institutional controls and monitoring, along with natural attenuation, may be considered a remedial alternative that 'will attain a standard of

performance that is equivalent to that required under the otherwise applicable standard, requirement, or limitation through use of another method or approach.'"

EPA Response: See Response to Comment H. 5, above.

H. 7. MassDEP requested "specifically listing 314 CMR 3.00 – the Surface Water Discharge Permit Program as a Chemical-Specific and an Action-Specific State ARAR because there may be instances where discharge to surface water may be necessary during the sediment remedy (right now it is only mentioned for consideration under the listing for their Federal NPDES program)."

EPA Response: The comment is acknowledged. Since the comment does not change the outcome of the FS, the document will not be revised. However, this ARAR will be included in the ROD.

H. 8. MassDEP recommended "removing the MCP Method 1 Groundwater Standards from the State Regulatory Requirements section and placing it instead in the Criteria, Advisories, and Guidance section as a To Be Considered. In addition, the listing is a little confusing as the requirement column only lists the Groundwater Standards, whereas the Consideration for FS column states that the standards will be considered for developing both soil and groundwater PRGs. The Method 1 Standards are only required at state sites that choose to conduct a Method 1-type risk assessment (not for Method 3 risk assessments which are roughly equivalent to the EPA risk method), therefore the standards are not used consistently at all sites. However, EPA is of course free to consider and use these numbers at any time during the Superfund process.

EPA Response: The comment is acknowledged. Since the comment does not change the outcome of the FS, the document will not be revised. However, this ARAR will be re-located in the ROD as suggested.

H. 9. MassDEP requested "listing 310 CMR 19.000 – Solid Waste Management as an Action-Specific ARAR because some of the remedy involves the capping of sediment and the surrounding banks, therefore some of the landfill capping requirements may be relevant and appropriate."

EPA Response: EPA does not believe that the cited provision is relevant and appropriate for the capping of sediment and surrounding banks.

H. 10. MassDEP commented regarding page 78, Section 2.1.4 of the MSGRP FS: "This section cites the MassDEP Method 1 standards as 'to be considered,' then states that the standards are relevant. The standards should solely be cited as 'to be considered' because the standards are not applied at every site (just those that choose to use Method 1). In addition, the section states that the soil categories are 'established based on a site-specific risk/exposure analysis.' Since the soil categories are already established and are only selected by the environmental professional for use after evaluating their site-specific exposure scenario, it would be more accurate to state the following: '...the category of standards used are selected based on a site-specific risk and exposure analysis.' "

EPA Response: The comment is acknowledged. Since the comment does not change the outcome of the FS, the document will not be revised.

I. EPA's Response to SMC and Pharmacia's Alternative Proposed Plan

SMC and Pharmacia submitted an Alternative Proposed Plan which varied in certain respects from EPA's Proposed Plan; EPA responds herein to that plan. No responses are provided for soil media (EPA's selected remedy SS-2 and SUB-2) due to SMC and Pharmacia's general agreement with EPA's selected remedy (i.e., institutional controls). Also, no response is provided for deep wetlands sediments (EPA's selected remedy DS-2) due to SMC and Pharmacia's general agreement with EPA's selected remedy (i.e., institutional controls), with the exception of SMC and Pharmacia's alternative remedial action for HBHA Wetland proposing the installation of various dikes, et. al.

I. 1. SMC and Pharmacia's "Alternative Remedial Action treats sediments in the HBHA Pond through placement of the subaqueous cap designed to treat groundwater in situ, addresses migration of sediments in the HBHA Pond and Wetland through construction of surface water flow controls (low-head dikes)."

SMC and Pharmacia commented that: the "subaqueous permeable reactive cap proposed for treating groundwater in the HBHA Pond would more effectively reduce the toxicity, mobility and volume of arsenic in groundwater entering the HBHA Pond and discharging to surface water than USEPA's Proposed Plan. The capping of HBHA Pond sediments would also more effectively reduce the mobility of arsenic in sediments through treatment than USEPA's proposed hydraulic dredging. Enhancing sedimentation in the HBHA Wetland through construction of low-head dikes would reduce the mobility of arsenic in sediments through burial of existing sediments by increasingly cleaner suspended particles. Specifically, the reactive cap would reduce release of arsenic into HBHA Pond surface water, where it can coprecipitate on iron hydroxide floe and suspended sediments entering and flowing through the HBHA Pond. Capping sediments in the HBHA Pond and the Wells G&H and Cranberry Bog Conservation Area wetlands would not constitute treatment. Conversely, potential stabilization of dewatered sediments hydraulically dredged from the HBHA Pond and excavated from near-shore wetlands areas would provide some reduction of mobility through treatment. In total, the Alternative Remedial Action would provide greater reduction of toxicity, mobility or volume through treatment, as summarized below."

EPA Response: EPA disagrees with the suggestion that a subaqueous cap is a better, more effective alternative than the selected remedy component HBHA-4. EPA's selected remedy will intercept all contaminated groundwater plumes from Industri-plex at the primary treatment area/cell (final location of low-head cofferdams will be determined during predesign), treats/sequesters contaminated groundwater, surface water and sediments in the northern portion of the HBHA Pond (primary and secondary treatment cells), periodically removes accumulated contaminated sediments from the bottom of the northern portion (primary and secondary treatment cells), constructs compensatory wetlands to mitigate any wetland function and value losses (including flood storage losses) associated with the selected remedy, removes contaminated sediment from the southern portion of HBHA Pond, and restores the southern portion of the HBHA Pond. The chemocline will be closely monitored and maintained and the aeration system will be designed to treat contaminants (including ammonia) to meet the surface water cleanup standards. EPA's selected remedy for the southern portion of the HBHA Pond requires off-site disposal of excavated sediments that complies with all federal and state transportation regulations. This portion of the selected remedy is a permanent solution for the southern portion of the HBHA Pond that permanently removes contaminated sediments and restores the wetland. Any traffic impacts during implementation of the selected remedy would be temporary and controlled through traffic control planning, resulting in a permanent solution for the sediments.

EPA's selected remedy will be implemented in accordance with federal and state regulation, including Section 404 of the Clean Water Act and the Executive Order for Floodplain Management, Exec. Order 11988 (1977), codified at 40 C.F.R. Part 6, App. A., 40 CFR 6.302(b), and control any releases during sediment removal and construction activities. This component of the remedy (contaminated sediment removal via dredging) is a common and proven technology. This component of the selected remedy reduces toxicity, mobility or volume of contaminants, is implementable, and results in a permanent solution (via contaminated sediment removal).

EPA's selected remedy incorporates portions of existing sequestering properties occurring in the HBHA Pond through the maintenance of the chemocline within the northern part of the HBHA Pond sediment retention area (primary treatment cell). Also, EPA's selected remedy intercepts the contaminated groundwater plumes (primary treatment cell) which provide the most significant source of iron to the pond. Baseflow surface water discharges from the Halls Brook, and baseflow and storm flow surface water discharges from minor tributaries will continue to provide suspended solids containing iron as well.

The existing sediments at the bottom of the HBHA Pond are not effectively removing arsenic from groundwater, as evident with the high concentrations of contamination in the surface water exceeding the NRWQC.

It is unlikely that the sediments at the bottom of the HBHA Pond possess "hundreds of years of remaining sorptive capacity", due to the ISRT contractor's application of inappropriate collection and test methods. Specifically, sediment collection procedures and batch sorption tests documented in the Supplemental Site Investigation Report, Industri-Plex Site (pp. 15-18, September 1997), prepared by the ISRT indicate that no precautions were taken to prevent oxidation of sediments from sampling locations SED-1 and SED-2 within the HBHA Pond. These procedures lead to oxidation of poorly crystalline iron sulfides that are produced within the sediments. Weight percent concentrations of acid volatile sulfides such as FeS have been identified in these sediments (R. T. Wilkin and R. G. Ford, 2002, Use of hydrochloric acid for determining solid-phase arsenic partitioning in sulfidic sediments. Environmental Science & Technology, 36(22): 4921-4927). Sampling procedures used by Wilkin and Ford (2002) to prevent sediment oxidation during collection and processing included: 1) capping and immediately freezing sediment cores upon retrieval; and 2) sectioning and drying frozen sediments within a glove box under an inert gas mixture (97% N_2:3% H_2). Dried sediments were stored in the glove box prior to extraction with hydrochloric acid to determine the fraction of acid volatile sulfides. Upon oxidation, FeS is converted to hydrous ferric oxide, which has a much higher sorption capacity for arsenic. Thus, the apparent sorption capacity based on ISRT batch sorption test data is not reflective of the actual sorption capacity of the intact sediments.

The current sediments at the bottom of the HBHA Pond are not stable or irreversible, as evident with the diffusion of contaminants from the sediment to the surface water, and the high concentrations of contamination in the surface water. The ability of the proposed alternative to convert these bottom sediments to stable and irreversible conditions is uncertain, and the sorption of capacity of the subaqueous cap is limited and reversible.

EPA did not choose a subaqueous cap as a component of the selected remedy due to poor reduction of toxicity, mobility, or volume through treatment, poor implementability, and unlikely success. The contaminated sediments at the bottom of the HBHA Pond are greater than 90% water and have a specific gravity very similar to water. This condition presents significant construction issues and concerns relative to displacement, entrainment, re-suspension and downstream migration during placement of cap materials. In addition, the deep surface water has very high concentrations of the contaminants of concern. Placing a cap with geogrid/geosynthetics on top of the deep surface water and sediment will likely cause the release of contaminated surface water and sediments that could re-contaminate the cap itself and downstream depositional areas.

The proposed subaqueous cap does not take into consideration that the source of the contaminated groundwater plumes discharging into the HBHA Pond are the buried and capped wastes at the Industri-plex site that will remain in place and continue to discharge into the pond in the future. The subaqueous cap has a limited capacity and will require periodic replacement which is not discussed in the proposed alternative. The replacement warrants previous cap materials to be removed and disposed off-site. The periodic removal of this cap material would be similar to dredging but would be further complicated by the installed geosynthetics. In addition, similar to reasons specified in the FS, the reliability of ZVI to effectively remove arsenic over a long period of time is uncertain given the chemical constituents of the contaminated groundwater. The high concentrations of dissolved solids present in groundwater will compete with the arsenic for binding sites of the ZVI and could cause contaminated groundwater to break through the cap and discharge unchecked into the water column. Another concern is that the cap materials could become clogged as a result of chemical reactions with the groundwater. In this situation, contaminated groundwater could migrate and discharge further downstream, beyond the treatment zone. In addition, the clogging and limited capacity of ZVI will require the subaqueous cap to be periodically removed and replaced.

The subaqueous cap will not address all contaminants of concerns, such as ammonia.

The proposed cap thickness is not discussed. In order to accomplish the goal of capturing all arsenic discharging from groundwater as stated, the cap thickness may be substantial. In this case the flood storage capacity of the HBHA Pond would be severely impacted, a condition of concern noted throughout SMC's and Pharmacia's comment documents. Mitigation of these flood storage losses do not appear to have been accounted for in SMC/Pharmacia's cost estimates.

Placing a cap over the contaminated sediments does not address the unacceptable ecological risks to the sediments, and does not mitigate for wetland function and value losses. Contrary to the proposed alternative, placing a cap over sediments impacts wetland functions and values.

The proposed alternative does not address contaminated surface water which exceeds NRWQC.

The proposed alternative would construct low head dikes in the HBHA Pond and HBHA Wetlands and attempts to control surface water flows in the HBHA Pond system. Under this aspect of the alternative proposal, the HBHA Pond and HBHA Wetland is incorporated into the treatment process and allows contamination to release and migrate downstream of the HBHA Pond and deposit throughout the HBHA wetlands. The release, downstream migration and deposition, and accumulation of contamination in sediments may cause future unacceptable ecological risks to the environment, as well as reduce wetland functions and values downstream, including flood storage. The proposal does not account for these impacts, and incorrectly suggests these impacts will improve habitat equivalent to mitigation.

The proposed alternative would result in greater impacts to the wetlands considering the intrusive construction activities associated with a cap are similar to dredging (both the selected remedy and proposed alternative disturb existing wetlands), the proposed alternative calls for greater intrusive activities over a broader area of wetlands (throughout the entire HBHA Wetlands), and the proposed alternative does not compensate for wetland function and value losses.

The dimensions of the HBHA Pond do not cause the atypical anoxic conditions present at the deep surface water of the HBHA Pond. Contaminated groundwater plumes that discharge into the HBHA Pond cause the chemocline and severe contamination in the sediments and surface water of the HBHA Pond, as well as the high conductivity, anoxic and reducing conditions in the deep surface water of the HBHA Pond.

The MSGRP RI documented the impacts of significant storm events on the HBHA Pond. The proposed alternative plan does not adequately account for these impacts.

> I. 2. Under SMC and Pharmacia's Alternative Remedial Action, "[i]nstitutional controls, which are ready to be inaugurated, would be used to restrict groundwater use at the West Hide Pile. MCP AULs would be used to restrict groundwater use on those other portions of the Study Area where arsenic and benzene are migrating in groundwater toward and discharging to HBHA Pond."
>
> SMC and Pharmacia commented that "[w]hile not necessary to achieve the RAOs, USEPA's Proposed Plan includes in situ bioremediation of groundwater at the West Hide Pile. Although bioremediation would generally be considered to provide greater overall

> protection of human health and the environment than institutional controls, the in situ bioremediation as described in USEPA's Proposed Plan will not achieve greater reduction of benzene concentrations than ongoing natural attenuation. Therefore, the institutional controls proposed as part of the Alternative Remedial Action are considered to provide comparable overall protection of human health and the environment.
>
> The in situ bioremediation as described in USEPA's Proposed Plan will not achieve greater reduction of benzene concentrations than ongoing natural attenuation. Therefore, the institutional controls proposed as part of the Alternative Remedial Action are considered to provide comparable compliance with ARARs.
>
> The in situ bioremediation as described in USEPA's Proposed Plan will not achieve greater reduction of benzene concentrations than ongoing natural attenuation. Therefore, the institutional controls proposed as part of the Alternative Remedial Action are considered to provide comparable long-term effectiveness.
>
> USEPA's Proposed Plan for in situ bioremediation of groundwater at the West Hide Pile will not provide any greater reduction of benzene toxicity, mobility or volume through treatment than ongoing natural attenuation processes. As a result, the institutional controls proposed as part of the Alternative Remedial Action, which do not include "treatment" per se, are considered comparable to USEPA's preferred alternative under this evaluation criterion."

EPA Response: Groundwater contamination at the West Hide Pile has been shown to present a risk to human health exceeding the remedial action objectives and cleanup standards, and has been a consistent source of benzene contamination to the groundwater at the Industri-plex site. Limited groundwater data were available at the West Hide Pile, and no surface water or sediment data were collected by the West Hide Pile to assess the extent of contaminated groundwater plume discharges and potential impacts to the adjacent wetlands. The 2002 groundwater data were not collected from the same location (vertical and horizontal position) or interval as previous groundwater data samples as suggested in the comment and can not be directly compared to determine a degree or percent reduction. EPA's selected remedy for the West Hide Pile will rapidly address the high concentrations of benzene in the groundwater and addresses the remedial action objectives and cleanup standards, as well as address any arsenic and ammonia contaminants in groundwater at the West Hide Pile.

Notwithstanding the above, if the following items can be adequately addressed during pre-design and remedial design activities, then implementation of the in-situ enhanced bioremediation system at the West Hide Pile may not be necessary: 1) Predesign investigations are adequately implemented for groundwater surface water and sediment near the West Hide Pile, East Hide Pile, and adjacent wetlands; 2) EPA further evaluates this data and determines there are no unacceptable human health risks or hazards or ecological risks; and 3) If Industri-plex OU-1 institutional controls are recorded on the properties with human health groundwater risks and adequately remove/reduce human health risks.

I. 3. SMC and Pharmacia's Alternative Remedial Action "addresses migration of sediments in the HBHA Pond and Wetland through construction of surface water flow controls (low-head dikes), addresses migration of sediments in the HBHA Pond and Wetland through construction of surface water flow controls (low-head dikes), and prevents exposure to deep wetland sediments through institutional controls."

SMC and Pharmacia commented that: "[t]he construction of flow control structures and devices in the HBHA Pond and HBHA Wetland would pose considerably fewer short-term impacts to the community than the hydraulic dredging of HBHA Pond sediments proposed in USEPA's Proposed Plan, which involves hazardous material processing on land, then offsite transport for disposal. Similarly, the construction of flow control structures would pose less risk of worker exposure to hazardous materials. Increased sedimentation from the flow control structures should not cause any adverse environmental impacts. The combination of capping and construction of flow control structures will immediately present an improved benthic habitat upon construction completion. However, anoxic conditions will to continue for HBHA Pond sediments under this or USEPA's Proposed Plan, since the pond was designed as a stormwater detention basin rather than aquatic habitat, and its very design is what creates the anoxic conditions."

EPA Response: EPA's selected remedy does not require action within the HBHA Wetlands, except for institutional controls to control future dredging activities within the wetland. EPA's selected remedy for the HBHA Pond (HBHA-4) will intercept all contaminated groundwater plumes from Industri-plex (final location of low-head cofferdams will be determined during predesign) at the primary treatment cell, treats/sequesters contaminated groundwater, surface water and sediments in the northern portion of the HBHA Pond (primary and secondary treatment cells), periodically removes accumulated contaminated sediments from the primary and secondary treatment cells, constructs compensatory wetlands to mitigate any wetland function and value losses (including flood storage losses) associated with the selected remedy, removes contaminated sediment from the southern portion of the HBHA Pond, and restores the southern portion of the HBHA Pond. Surface water releases from the northern portion of the HBHA Pond (outlet of the secondary treatment cell) must comply with surface water cleanup standards. EPA expects that the selected remedy will improve habitat and flood storage capacity in the watershed.

Placing cap materials within the pond will impact the HBHA Pond's wetland functions and values, and decrease the existing flood storage capacity.

Placing a cap over the contaminated sediments does not address the unacceptable ecological risks associated with the sediments, and does not mitigate wetland function and value losses. Contrary to the proposed alternative, placing a cap over sediments impacts wetland and value functions.

The proposed alternative would construct low head dikes in the HBHA Pond and HBHA Wetlands and attempts to control surface water flows in the HBHA system. Under this aspect of the alternative proposal, the HBHA Pond and HBHA Wetland are incorporated into the treatment process and allow contaminated groundwater and sediments to be released, migrate downstream, and deposit and accumulate in the HBHA Pond and HBHA Wetlands. The release, downstream migration and deposition, and accumulation of contaminated sediments may cause future unacceptable ecological risks to the environment, as well as reduce wetland functions and values downstream, including flood storage. The proposal does not account for these impacts, and does not properly mitigate for these lost wetland functions and values.

The proposed alternative would result in greater impacts to the wetlands considering that a broader area of wetlands will require disturbance and construction activities (i.e., throughout the HBHA Wetlands, the proposed alternative does not construct wetlands to compensate for wetland function and value losses (e.g. proposed alternative suggests deposited contaminated solids/sediments serves as the basis for creating new benthic invertebrate habitats)) nor does it make provisions for mitigating flood storage losses.

The proposed alternative does not address all of the contaminants of concern, specifically benzene and ammonia.

The proposed alternative does not address contaminants in surface water which exceed surface water cleanup standards, such as ammonia.

> I. 4. SMC and Pharmacia's Alternative Proposed Plan proposes capping near-shore sediments in the Wells G&H Wetland and the Cranberry Bog Conservation Area. SMC and Pharmacia commented that: "[c]apping near-shore sediments in the Wells G&H Wetland and the Cranberry Bog Conservation Area would isolate these sediments in place in a manner that would prevent human exposure. Installation of these caps would create upland islands that would increase habitat diversity within the existing wetland systems. Capped areas would be re-vegetated with plants inhospitable to humans to create natural biological barriers to the capped areas and deter access to deep sediments in the interior of the wetland. Capping would add to the mosaic of habitats present in this riparian system, providing new habitat types and increased habitat edges and assure long-term protection of human health and the wetland ecosystem."

EPA Response: EPA disagrees with the suggestion that capping near shore sediments is a better, more effective alternative than the selected remedy component NS-4. EPA's selected remedy will remove the contaminated near shore sediments, dispose of the contaminated sediments off-site, and restore the area. The selected remedy is a permanent solution for the near shore sediments contributing to unacceptable risks. Any traffic impacts during implementation of the selected remedy would be temporary and controlled through traffic control planning. Off-site disposal will comply with all federal and state transportation requirements.

EPA's selected remedy will be implemented in accordance with federal and state regulation, including Section 404 of the Clean Water Act and the Executive Order for Floodplain Management, Exec. Order 11988 (1977), codified at 40 C.F.R. Part 6, App. A., 40 CFR 6.302(b), and control any releases during sediment removal construction activities. This component of the remedy (contaminated sediment removal via dredging) is a common and proven technology.

This component of the selected remedy reduces toxicity, mobility or volume of contaminants, is implementable, and results in a permanent solution (via contaminated sediment removal).

Unless dredging is incorporated into the design, the proposed capping alternative will increase the elevation over the sediments and increase accessibility to deeper/interior wetlands and generally higher concentrations of contaminated sediments.

The proposed alternative does not account for contamination desorption impacts or long-term erosion impacts. Sediment desorption impacts may re-contaminate the cap, while long-term erosion impacts may impact long-term effectiveness and permanence of the cap.

The proposed alternative, if compared with EPA's selected remedy, would provide less long-term effectiveness and permanence, and poorer reduction of toxicity, mobility and volume of contaminated sediments.

The proposed alternative inappropriately mitigates for lost wetland functions and values through the use of its cap by considering the change in elevation as providing "new habitat types and increased ecotones", and by HBHA Wetland mitigations by allowing contaminated sediments to deposit and accumulate and considering these elevated contaminated sediment new habitat with supplemental vegetation plantings.

Placing cap material over the sediments will impact wetland functions and values, including decreased flood storage capacity, which are not addressed.

The degree of impacts on the wetlands during construction would be similar to EPA's selected remedy. However, the proposed alternative when compared with EPA's selected remedy would result in greater impacts to the wetlands considering it does not construct wetlands to compensate for wetland function and value losses and will reduce flood storage capacity within the watershed.

The proposed installation of vegetation that would be inhospitable to humans to create biological barriers would not adequately protect human health, provide long-term permanence, or reduce toxicity, mobility, or volume of contamination to future accessible deeper/interior wetland sediments.

Biological barriers would be inconsistent with the land use of the property which includes open space (including recreational use, e.g. periodic paint ball games) and future recreational reuse.

Costs to implement and maintain institutional controls were not accounted for in the evaluation of the sediment capping alternative for near-shore sediments.

I. 5. SMC and Pharmacia commented that: "[b]y adapting an integrated approach to site monitoring, monitoring efforts could be focused on arsenic-containing and benzene-containing groundwater discharging from the Industri-plex Superfund Site to surface water in Halls Brook Holding Area Pond, arsenic accumulation in HBHA Pond sediments, the potential for arsenic-containing groundwater from Former Lake

Mishawum to discharge into HBHA Wetland and arsenic flux from Hall Brook Holding area wetland via the surface water pathway (Figure 2). Groundwater discharge from the site would be monitored by installing three well clusters at the north end of HBHA Pond to determine whether or not arsenic concentrations were increasing, decreasing or steady state. Sampling would be conducted quarterly for two years, semiannually for three years and annually thereafter. Sediment sampling would be performed annually at three locations in HBHA Pond (upstream end, center and downstream end) to determine the amount of arsenic sorbed to the sediments and the amount of sorption capacity remaining. Three monitoring well clusters would be installed on the eastern edge of HBHA Wetland to determine if arsenic was mobilized from buried lake bottom sediment and migrating to the wetland. One well cluster would be located at the north end of HBHA Wetland, one well cluster would be located in the center of the wetland and the other well cluster would be located at the south end of the wetland. Sampling would be conducted semiannually for five years, annually for five years and discontinued if arsenic is not discharging to surface water at concentrations that would cause an adverse impact on public health or the environment. To determine arsenic flux from HBHA Wetland, a surface water sampling station would be maintained at the outlet of the wetland to sample monthly baseflow and storms with greater than 0.5 inches of precipitation. Samples would be analyzed for TSS and Total and Dissolved Arsenic."

EPA Response: The monitoring program generally described in EPA's Proposed Plan is the result of combining individual alternatives from the FS, which presented monitoring programs specific to the medium and remedial alternative selected. EPA recognizes that monitoring efficiencies can be realized when a multi-media approach is taken. An EPA-approved monitoring program will be performed consistent with previous RI monitoring methods and procedures so that on-site and off-site contaminant trends and migrations patterns can be adequately evaluated and compared to previous RI data. Monitoring will also be performed to evaluate the performance of the selected remedy. Specific details of the monitoring program will be developed during remedial design process.

J. Questions and Comments Regarding Liability and Enforcement

J. 1. SMC and Pharmacia made repeated claims that EPA's decision-making was "arbitrary and capricious and otherwise not in accordance with law." SMC and Pharmacia further challenge the constitutionality of CERCLA both as drafted and applied, and claim that any effort to compel them to perform or pay for the remedy would constitute a taking without just compensation.

EPA Response: Legal challenges to EPA's decision-making process or to EPA's legal authority are not considered comments on the remedy, but rather comments on the enforcement process and thus are not addressed in this responsiveness summary.

J. 2. SMC and Pharmacia claim that components of the Proposed Alternative are governed by the Consent Decree they entered in 1989 and any attempts to alter the Consent Decree must be approved by the United States District Court for the District of Massachusetts.

EPA Response: Comments regarding the 1989 Consent Decree are not considered comments on the remedy, but rather comments on the enforcement process. However, it should be noted that EPA has carefully reviewed the terms of that settlement and has determined that the selected remedy is fully consistent with that Consent Decree.

J. 3. Several commenters expressed concern that they would be forced to expend funds on actions such as the implementation of institutional controls despite having alleged defenses to liability. One commenter noted that under Massachusetts state law and regulation, parties with defenses to liability have a reduced burden with regard to institutional controls. One commenter suggested that non-liable parties should be granted covenants not to sue or other forms of contribution protection in exchange for implementing institutional controls.

EPA Response: Comments regarding liability are not considered comments on the remedy, but rather comments on the enforcement process and thus are not addressed in this responsiveness summary. See Section B for response to comments re: institutional controls.

J. 4. One commenter asked who would be liable if they incurred damages resulting from response actions on their property.

EPA Response: Comments regarding potential liability from response actions are not addressed in this responsiveness summary. However, whether the response actions are undertaken by EPA or by private parties, EPA will ensure that all contractors are fully insured.

J. 5. One commenter asked how much money has been spent on studies and litigation.

EPA Response: EPA estimates that the various studies supporting this Record of Decisions have cost approximately $10 million. Currently, no litigation costs have been incurred regarding the selected remedy.

K. Questions and Comments Regarding Errors or Omissions in the Feasibility Study

K. 1. The consultant for ASC commented that: "Section 3.4.5.2 (Sediment Retention Area at Northern Portion of the HBHA Pond), on page 3-31, paragraph 2, describes 'construction of a dual low-head cofferdam system starting at the approximate location of the mouth of the Halls Brook and continuing west across HBHA Pond… with the northern portion serving as the sediment retention and secondary polishing area.' It should be noted that Hall Brook enters HBHA on the western shore; thus, if the cofferdam is constructed from the brook outlet across the pond, construction will proceed to the east and not the west.

Page 3-31, paragraph 3, makes reference to 'diffusion from accumulated sediments and subsequent chemocline precipitation.' It is not clear what is meant by these statements and what they refer to. It appears that this phrase was inadvertently appended to the sentence in which it appeared."

EPA response: The comments are acknowledged. However, since the errors do not change the outcome of the FS, the document will not be revised.

K. 2. The consultant for ASC commented that: "[o]n page 3-31, paragraph 3, sentence 3, it is not clear how the sediment storage figure of '2,000 yd^3 of in-place sediment per vertical foot' is arrived at. Is this an estimate arrived at from carefully performed measurements and calculations, or is this simply a rough estimate? EPA should describe how the sediment storage volume was estimated."

EPA Response: The estimate provided is a rough estimate of the in-place volume of sediment that would accumulate over the estimated area of the settling basin that is presented in the FS report. The surface area of the sediment retention basin that is depicted in the FS is approximately 56,000 square feet. One foot of sediment depth represents an average estimate of sediment depth assuming that the sediment thickness will be greater towards the center of the pond and lesser near the shores.

56,000 SF x 1 LF = 56,000 CF
56,000 CF x 1 CY/27 CF = 2,074 CY

K. 3. MassDEP commented that: it "would prefer that the term 'concur' not be used in [Section 2.1.4, on page 78] with reference to the findings of the risk assessment primarily because DEP has a formal concurrence process in relation with the ROD that has not yet occurred. DEP has evaluated the federal and the state risk assessment methodologies and views the EPA risk assessment procedures as equivalent to those that are conducted under the MCP (Method 3), and we in this case consider the remedial goals developed from that process adequate."

EPA Response: The comment is acknowledged. However, since the comment does not change the outcome of the FS, the document will not be revised.

K. 4. MassDEP recommended that: "the last sentence in [Section 2.1.4, on page 78] which refers to institutional controls be moved to another section because arguing the reasonableness of one of the remedial alternatives seems out of place within the ARARs section."

EPA Response: The comment is acknowledged. However, since the comment does not change the outcome of the FS, the document will not be revised.

K. 5. SMC and Pharmacia's consultant commented that: "the PRG equations provided in Appendix A of the FS (USEPA, 2005b), are incorrect on both the risk assessment and simple arithmetic levels."

EPA Response: As noted in the comment, the PRG equations presented in the MSGRP FS are incorrect. However, the numerical PRGs were calculated utilizing the original spreadsheets from the human health risk assessment and are therefore, not impacted. The correct equation will be incorporated into the Record of Decision.

TABLES AND FIGURES

Table G-1

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

***Scenario Timeframe:* Current**
Medium: Sediment
Exposure Medium: Sediment

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure (1)
		Minimum	Maximum					
Station WH								
	Arsenic	4.7	3230	mg/kg	12 / 12	1910	mg/kg	95% UCL - T
Station CB-03								
	Arsenic	9.1	1410	mg/kg	12 / 12	595	mg/kg	95% UCL - G

Key

(1) Statistics: Maximum Detected Value (Max); 95% UCL of Transformed Data (95% UCL - T); 95% UCL of Normal Data (95% UCL - N); 95% UCL of Non-parametric Data (95% UCL - NP); 95% UCL of Gamma Distributed Data (95% UCL - G); Arithmetic Mean (Mean)

The table represents the current chemicals of concern (COCs) and exposure point concentrations (EPCs) for each of the COCs detected in sediment (i.e., the concentrations that will be used to estimate the exposure and risk for each COC in sediment). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at each station), the EPC, and how the EPC was derived. This table indicates that arsenic is the only COC in sediment at the site. The 95% UCL on the arithmetic mean was used as the EPC for arsenic.

Table G-2

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

Scenario Timeframe: Future
Medium: Sediment
Exposure Medium: Sediment

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure (1)
		Minimum	Maximum					
Station 13/TT-27								
	Benzo(a)pyrene	0.15	1.7	mg/kg	6 / 6	1.3	mg/kg	95% UCL - N
	Arsenic	15.9	4210	mg/kg	9 / 9	3635	mg/kg	95% UCL - G
Station WH								
	Benzo(a)pyrene	1	1	mg/kg	1 / 1	1	mg/kg	Max
	Arsenic	4.7	3230	mg/kg	12 / 12	1910	mg/kg	95% UCL - T
Station NT-3								
	Arsenic	6.6	3230	mg/kg	22 / 22	496	mg/kg	95% UCL - T
Station CB-03								
	Arsenic	9.1	1410	mg/kg	12 / 12	595	mg/kg	95% UCL - G

Key

(1) Statistics: Maximum Detected Value (Max); 95% UCL of Transformed Data (95% UCL - T); 95% UCL of Normal Data (95% UCL - N); 95% UCL of Non-parametric Data (95% UCL - NP); 95% UCL of Gamma Distributed Data (95% UCL - G); Arithmetic Mean (Mean)

The table represents the future chemicals of concern (COCs) and exposure point concentrations (EPCs) for each of the COCs detected in sediment (i.e., the concentrations that will be used to estimate the exposure and risk for each COC in sediment). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the site), the EPC, and how the EPC was derived. This table indicates that arsenic is the most frequently detected COC in sediment at the site. *The 95% UCL on the arithmetic mean* was used as the EPC for arsenic, and for the organic chemical benzo(a)pyrene at Station 13/TT-27. Due to the limited amount of sample data for benzo(a)pyrene at Station WH, the maximum detected concentration was used as the default EPC

Table G-3

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

Scenario Timeframe: Future
Medium: Sediment
Exposure Medium: Sediment Cores

Exposure Point	Chemical of Concern	Concentration Detected Minimum	Concentration Detected Maximum	Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure (1)
SC02								
	Arsenic	27	1600	mg/kg	4 / 4	1600	mg/kg	Max
SC05								
	Arsenic	210	900	mg/kg	4 / 4	900	mg/kg	Max
SC06								
	Arsenic	66	1700	mg/kg	4 / 4	1700	mg/kg	Max
SC08								
	Arsenic	140	1250	mg/kg	2 / 4	1250	mg/kg	Max

Key

(1) Statistics: Maximum Detected Value (Max); 95% UCL of Transformed Data (95% UCL - T); 95% UCL of Normal Data (95% UCL - N); 95% UCL of Non-parametric Data (95% UCL - NP); 95% UCL of Gamma Distributed Data (95% UCL - G); Arithmetic Mean (Mean)

The table represents the future chemicals of concern (COCs) and exposure point concentrations (EPCs) for each of the COCs detected in sediment cores (i.e., the concentrations that will be used to estimate the exposure and risk for each COC in sediment cores). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the site), the EPC, and how the EPC was derived. This table indicates that arsenic is the only COC detected in sediment cores at the site. Due to the limited amount of sample data available for arsenic, the maximum detected concentration was used as the default EPC.

Table G-4

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure (1)
		Minimum	Maximum					
SO (Former Mishawum Lake Bed Area)	Arsenic	5.7	192	mg/kg	20 / 20	92	mg/kg	95% UCL - T

Key

(1) Statistics: Maximum Detected Value (Max); 95% UCL of Transformed Data (95% UCL - T); 95% UCL of Normal Data (95% UCL - N); 95% UCL of Non-parametric Data (95% UCL - NP); 95% UCL of Gamma Distributed Data (95% UCL - G); Arithmetic Mean (Mean)

The table represents the future chemicals of concern (COCs) and exposure point concentrations (EPCs) for each of the COCs detected in surface soil (i.e., the concentrations that will be used to estimate the exposure and risk for each COC in surface soil). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the site), the EPC, and how the EPC was derived. This table indicates that arsenic is the only COC in surface soil at the site. The 95% UCL on the arithmetic mean was used as the EPC for arsenic.

Table G-5

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Subsurface Soil

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure (1)
		Minimum	Maximum					
SO (Former Mishawum Lake Bed Area)	Arsenic	1.6	2680	mg/kg	14 / 14	1900	mg/kg	95% UCL - T

Key

(1) Statistics: Maximum Detected Value (Max); 95% UCL of Transformed Data (95% UCL - T); 95% UCL of Normal Data (95% UCL - N); 95% UCL of Non-parametric Data (95% UCL - NP); 95% UCL of Gamma Distributed Data (95% UCL - G); Arithmetic Mean (Mean)

The table represents the future chemicals of concern (COCs) and exposure point concentrations (EPCs) for each of the COCs detected in *subsurface soil (i.e., the concentration* that will be used to estimate the exposure and risk for each COC in subsurface soil). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the site), the EPC, and how the EPC was derived. This table indicates that arsenic is the only COC in subsurface soil at the site. The 95% UCL on the arithmetic mean was used as the EPC for arsenic.

Table G-6

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Shallow Groundwater

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure (1)
		Minimum	Maximum					
Study Area								
	Arsenic	0.252	24432.5	ug/L	93 / 107	3427	ug/L	95% UCL - NP

Key

(1) Statistics: Maximum Detected Value (Max); 95% UCL of Transformed Data (95% UCL - T); 95% UCL of Normal Data (95% UCL - N); 95% UCL of Non-parametric Data (95% UCL - NP); 95% UCL of Gamma Distributed Data (95% UCL - G); Arithmetic Mean (Mean)

The table represents the chemicals of concern (COCs) and exposure point concentrations (EPCs) for each of the COCs detected in shallow groundwater (i.e., the concentrations that will be used to estimate the exposure and risk for each COC in shallow groundwater). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the site), the EPC, and how the EPC was derived. This table indicates that arsenic is the only COC in shallow groundwater at the site. The 95% UCL on the arithmetic mean was used as the EPC for arsenic in shallow groundwater.

Table G-7

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater (All Depths)

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure (1)
		Minimum	Maximum					
Study Area								
	1,2-Dichloroethane	0.17	48	ug/L	2 / 153	2.1	ug/L	95% UCL - NP
	Ammonia	49	2710000	ug/L	67 / 92	320000	ug/L	95% UCL - NP
	Benzene	0.1	69000	ug/L	126 / 445	2389	ug/L	95% UCL - NP
	Trichloroethene	0.15	110	ug/L	31 / 153	9.5	ug/L	95% UCL - NP
	Naphthalene	3	220	ug/L	12 / 68	28	ug/L	95% UCL - NP
	Arsenic	0.161	24432.5	ug/L	288 / 357	1130	ug/L	95% UCL - NP

Key

(1) Statistics: Maximum Detected Value (Max); 95% UCL of Transformed Data (95% UCL - T); 95% UCL of Normal Data (95% UCL - N); 95% UCL of Non-parametric Data (95% UCL - NP); 95% UCL of Gamma Distributed Data (95% UCL - G); Arithmetic Mean (Mean)

The table represents the chemicals of concern (COCs) and exposure point concentrations (EPCs) for each of the COCs detected in groundwater (i.e., the concentrations that will be used to estimate the exposure and risk for each COC in groundwater). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the site), the EPC, and how the EPC was derived. This table indicates that the inorganic chemical, arsenic, is the most frequently detected COC in groundwater at the site. The 95% UCL on the arithmetic mean was used as the EPC for all COCs detected in groundwater.

Table G-8

Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal

Chemical of Concern	Oral Cancer Slope Factor	Dermal Cancer Slope Factor	Slope Factor Units	Weight of Evidence/Cancer Guideline Description	Source	Date (MM/DD/YYYY)
Benzene	5.5E-02	5.5E-02	$(mg/kg\text{-}day)^{-1}$	A	IRIS	01/05/05
Trichloroethene	4.0E-01	4.0E-01	$(mg/kg\text{-}day)^{-1}$	C-B2	NCEA	01/05/05
Benzo(a)pyrene	7.3E+00	7.3E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	01/05/05
Arsenic (other media)	1.5E+00	1.5E+00	$(mg/kg\text{-}day)^{-1}$	A	IRIS	01/05/05
Arsenic (sediment)	7.7E-01	1.5E+00	$(mg/kg\text{-}day)^{-1}$	A	Site-specific (1)	

Pathway: Inhalation

Chemical of Concern	Unit Risk	Units	Inhalation Cancer Slope Factor	Weight of Evidence/Cancer Guideline Description	Source	Date (MM/DD/YYYY)
1,2-Dichloroethane	2.6E-05	$(ug/m^3)^{-1}$	N/A	B2	IRIS	01/05/05
Ammonia	N/A	$(ug/m^3)^{-1}$	N/A	D	IRIS	08/01/05
Benzene	7.8E-06	$(ug/m^3)^{-1}$	N/A	A	IRIS	01/05/05
Trichloroethene	1.1E-04	$(ug/m^3)^{-1}$	N/A	C-B2	NCEA	01/05/05
Naphthalene	N/A	$(ug/m^3)^{-1}$	N/A	C	IRIS	01/05/05

Key

N/A: Not applicable

IRIS: Integrated Risk Information System, U.S. EPA

NCEA: National Center for Environmental Assessment, U.S. EPA

CalEPA = California Environmental Protection Agency

(1) The IRIS oral cancer slope factor was adjusted based on the results of a site-specific sediment arsenic bioavailability study.

EPA Group

A - Human carcinogen

B1 - Probable human carcinogen - Indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

This table provides the carcinogenic risk information which is relevant to the contaminants of concern in sediment, soil, and groundwater. At this time, slope factors are not available for the dermal route of exposure. Thus, the dermal slope factors used in this assessment have been extrapolated from oral values. An adjustment factor is sometimes applied, and is dependent upon how well the chemical is absorbed via the oral route. Adjustments are particularly important for chemicals with less than 50% absorption via the ingestion route. However, adjustment is not necessary for the chemicals evaluated at this site. Therefore, the same values presented above were used as the dermal carcinogenic slope factors for these contaminants. Three of the COCs are also considered carcinogenic via the inhalation route. Benzo(a)pyrene and arsenic, as non-volatile contaminants, were not included in the evaluation of inhalation exposures.

Table G-9

Non-Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal

Chemical of Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Dermal RfD	Dermal RfD Units	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfD: Target Organ	Dates of Rfd: Target Organ (MM/DD/YYYY)
Benzene	Chronic	4.0E-03	mg/kg-day	4.0E-03	mg/kg-day	Immune System	300	IRIS	01/05/05
Trichloroethene	Chronic	3.0E-04	mg/kg-day	3.0E-04	mg/kg-day	Liver	3000	NCEA	01/05/05
Benzo(a)pyrene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic (other media)	Chronic	3.0E-04	mg/kg-day	3.0E-04	mg/kg-day	Skin	3	IRIS	01/05/05
Arsenic (sediment)	Chronic	5.9E-04	mg/kg-day	3.0E-04	mg/kg-day	Skin	3	Site-specific (1)	
Arsenic (other media)	Subchronic	3.0E-04	mg/kg-day	3.0E-04	mg/kg-day	Skin	3	IRIS	01/05/05
Arsenic (sediment)	Subchronic	5.9E-04	mg/kg-day	3.0E-04	mg/kg-day	Skin	3	Site-specific (1)	

Pathway: Inhalation

Chemical of Concern	Chronic/ Subchronic	Inhalation RfC	Inhalation RfC Units	Inhalation RfD	Inhalation RfD Units	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfC: RfD: Target Organ	Dates (MM/DD/YYYY)
1,2-Dichloroethane	Chronic	5	ug/m^3	N/A	N/A	Liver/Kidney/GI System	3000	NCEA	01/05/05
Ammonia	Chronic	100	ug/m^3	N/A	N/A	Respiratory	30	IRIS	08/01/05
Benzene	Chronic	30	ug/m^3	N/A	N/A	Immune System	300	IRIS	01/05/05
Trichloroethene	Chronic	40	ug/m^3	N/A	N/A	Liver/CNS	3000	NCEA	01/05/05
Naphthalene	Chronic	3	ug/m^3	N/A	N/A	Respiratory	3000	IRIS	01/05/05

Key

N/A - No information available

IRIS - Integrated Risk Information System, U.S. EPA

NCEA - National Center for Environmental Assessment, U.S. EPA

(1) The IRIS oral reference dose was adjusted based on the results of a site-specific sediment arsenic bioavailability study.

This table provides non-carcinogenic risk information which is relevant to the contaminants of concern in soil, sediment, and groundwater. Three of the COCs have oral toxicity data indicating their potential for adverse non-carcinogenic health effects in humans. Chronic and subchronic toxicity data available for the three COCs for oral exposures have been used to develop chronic and subchronic oral reference doses (RfDs), provided in this table. The available chronic and subchronic toxicty data indicate that benzene affects the immune system, trichloroethene affects the liver, and arsenic affects the skin. Reference doses are not available for the carcinogenic polycyclic aromatic hydrocarbon, benzo(a)pyrene. Dermal RfDs are not available for any of the COCs. As was the case for the carcinogenic data, dermal RfDs can be extrapolated from oral RfDs by applying an adjustment factor as appropriate. However, no adjustment is necessary for any of the COCs, and the oral RfDs discussed were used as the dermal RfDs for all COCs. Inhalation reference concentrations (RfCs) are available for the five volatile COCs evaluated for the inhalation pathway. Benzo(a)pyrene and arsenic, as a non-volatile contaminants, were not included in the evaluation of inhalation exposures.

Table G-10

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment	Sediment	Station WH	Arsenic	Skin	2E+00	- -	5E-01	2E+00
							Sediment Hazard Index Total =	2E+00
							Skin Hazard Index =	2E+00
Sediment	Sediment	Station CB-03	Arsenic	Skin	2E+00	- -	6E-01	3E+00
							Sediment Hazard Index Total =	3E+00
							Skin Hazard Index =	3E+00

Key

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.

-- Route of exposure is not applicable to this medium.

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of the hazard quotients) for all routes of exposure for the current child and adult recreational user exposed to sediment. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) of greater than 1 indicates the potential for adverse noncancer effects. The estimated HI of 2 for Station WH and 3 for Station CB-03 indicates that the potential for adverse noncancer effects could occur from exposure to contaminated sediment containing arsenic.

Table G-11

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Future
Receptor Population: Recreational User
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment	Sediment	Station 13/TT-27	Benzo(a)pyrene	2E-06	--	1E-06	3E-06
			Arsenic	5E-04	--	2E-04	7E-04
						Sediment Risk Total =	7E-04
Sediment	Sediment	Station WH	Benzo(a)pyrene	1E-06	--	1E-06	2E-06
			Arsenic	3E-04	--	9E-05	4E-04
						Sediment Risk Total =	4E-04
						Total Risk =	N/A

Key

-- Route of exposure is not applicable to this medium.

N/A - Not applicable. Summing of sediment risks across exposure points is not applicable since risks were estimated assuming all of a receptor's exposure occurred at each station.

This table provides risk estimates for the significant routes of exposure for the future child and adult recreational user. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of a child's and adult's exposure to sediment, as well as the toxicity of the COCs (benzo(a)pyrene and arsenic). The total risk from direct exposure to contaminated sediment at this site to a future child and adult recreational user is estimated to be 7×10^{-4} for Station 13/TT-27 and 4×10^{-4} for Station WH. The COC contributing most to this risk level is arsenic in sediment. This risk level indicates that if no clean-up action is taken, an individual would have an increased probability of 7 in 10,000 and 4 in 10,000 of developing cancer as a result of site-related exposure to the COCs at Stations 13/TT-27 and WH, respectively.

Table G-12

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Recreational User
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment	Sediment	Station 13/TT-27	Arsenic	Skin	9E+00	--	3E+00	1E+01
							Sediment Hazard Index Total =	1E+01
							Skin Hazard Index =	1E+01
Sediment	Sediment	Station WH	Arsenic	Skin	5E+00	--	2E+00	6E+00
							Sediment Hazard Index Total =	6E+00
							Skin Hazard Index =	6E+00
Sediment	Sediment	Station NT-3	Arsenic	Skin	1E+00	--	4E-01	2E+00
							Sediment Hazard Index Total =	2E+00
							Skin Hazard Index =	2E+00
Sediment	Sediment	Station CB-03	Arsenic	Skin	2E+00	--	6E-01	3E+00
							Sediment Hazard Index Total =	3E+00
							Skin Hazard Index =	3E+00

Key

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.

-- Route of exposure is not applicable to this medium.

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of the hazard quotients) for all routes of exposure for the future child and adult recreational user. The Risk *Assessment Guidance* (RAGS) *for Superfund states that, generally*, a hazard index (HI) of greater than 1 indicates the potential for adverse noncancer effects. The estimated HIs of 10, 6, 2, and 3 indicate that the potential for adverse noncancer effects could occur from exposure to contaminated sediment containing arsenic at Stations 13/TT-27, WH, NT-3, and CB-03, respectively.

Table G-13

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Dredger
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment	Sediment Cores	SC02	Arsenic	Skin	4E+00	--	7E-01	4E+00
							Sediment Hazard Index Total =	4E+00
							Skin Hazard Index =	4E+00
Sediment	Sediment Cores	SC05	Arsenic	Skin	2E+00	--	4E-01	2E+00
							Sediment Hazard Index Total =	2E+00
							Skin Hazard Index =	2E+00
Sediment	Sediment Cores	SC06	Arsenic	Skin	4E+00	--	7E-01	4E+00
							Sediment Hazard Index Total =	4E+00
							Skin Hazard Index =	4E+00
Sediment	Sediment Cores	SC08	Arsenic	Skin	3E+00	--	5E-01	3E+00
							Sediment Hazard Index Total =	3E+00
							Skin Hazard Index =	3E+00

Key

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.

-- Route of exposure is not applicable to this medium.

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of the hazard quotients) for all routes of exposure for the future dredging worker. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) of greater than 1 indicates the potential for adverse noncancer effects. The estimated HIs of 4, 2, 4, and 3 indicate that the potential for adverse noncancer effects could occur from exposure to contaminated sediment cores containing arsenic at locations SC02, SC05, SC06, and SC08, respectively.

Table G-14

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Future
Receptor Population: Day Care Child
Receptor Age: Young Child (ages 1-6)

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Subsurface Soil	SO (Former Mishawum Lake Bed Area)	Arsenic	1E-03	--	1E-04	1E-03
						Soil Risk Total =	1E-03
						Total Risk =	1E-03

Key

-- Route of exposure is not applicable to this medium.

This table provides risk estimates for the significant routes of exposure for the future day care child. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of an child's exposure to subsurface soil, as well as the toxicity of the COC (arsenic). The total risk from direct exposure to contaminated subsurface soil at this site to a future day care child is estimated to be 1×10^{-3}. The only COC contributing to this risk level is arsenic in subsurface soil. This risk level indicates that if no clean-up action is taken, an individual would have an increased probability of 1 in 1,000 of developing cancer as a result of site-related exposure to arsenic.

Table G-15

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Day Care Child
Receptor Age: Young Child (ages 1-6)

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	SO (Former Mishawum Lake Bed Area)	Arsenic	Skin	2E+00	--	1E-01	2E+00
							Soil Hazard Index Total =	2E+00
							Skin Hazard Index =	2E+00
Soil	Subsurface Soil	SO (Former Mishawum Lake Bed Area)	Arsenic	Skin	3E+01	--	3E+00	4E+01
							Soil Hazard Index Total =	4E+01
							Skin Hazard Index =	4E+01

Key

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.

-- Route of exposure is not applicable to this medium.

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of the hazard quotients) for all routes of exposure for the future day care child. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) of greater than 1 indicates the potential for adverse noncancer effects. The estimated HIs of 2 and 40 indicate that the potential for adverse noncancer effects could occur from exposure to contaminated surface and subsurface soil, respectively, containing arsenic.

Table G-16

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Subsurface Soil	SO (Former Mishawum Lake Bed Area)	Arsenic	Skin	6E+00	2E-01	6E-01	7E+00
							Soil Hazard Index Total =	7E+00
Groundwater	Shallow Groundwater	Study Area	Arsenic	Skin	3E+00	--	2E-01	3E+00
							Groundwater Hazard Index Total =	3E+00
							Receptor Hazard Index =	1E+01
							Skin Hazard Index =	1E+01

Key

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.

-- Route of exposure is not applicable to this medium.

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of the hazard quotients) for all routes of exposure for the future construction worker. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) of greater than 1 indicates the potential for adverse noncancer effects. The estimated HI of 10 indicates that the potential for adverse noncancer effects could occur from exposure to contaminated subsurface soil and shallow groundwater containing arsenic.

Table G-17

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Study Area	1,2-Dichloroethane	--	1E-05	--	1E-05
			Benzene	2E-05	4E-03	4E-05	4E-03
			Trichloroethene	7E-07	2E-04	1E-06	2E-04
			Arsenic	3E-04	--	2E-05	3E-04
						Groundwater Risk Total =	5E-03
						Total Risk =	5E-03

Key

-- Route of exposure is not applicable to this medium.

This table provides risk estimates for the significant routes of exposure for the future industrial worker exposed to groundwater used as process water. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of an industrial worker's exposure to groundwater, as well as the toxicity of the COCs (1,2-dichloroethane, benzene, trichloroethene, and arsenic). The total risk from direct exposure to contaminated groundwater at this site to a future industrial worker is estimated to be 5×10^{-3}. The COCs contributing most to this risk level are benzene, trichloroethene, and arsenic in groundwater. This risk level indicates that if no clean-up action is taken, an individual would have an increased probability of 5 in 1,000 of developing cancer as a result of site-related exposure to the COCs.

Table G-18

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Study Area	Benzene	Immune System	--	5E+01	--	5E+01
			Naphthalene	Respiratory	--	6E+00	--	6E+00
			Arsenic	Skin	2E+00	--	1E-01	2E+00
							Groundwater Hazard Index Total =	6E+01
							Immune System Hazard Index =	5E+01
							Respiratory Hazard Index =	6E+00
							Skin Hazard Index =	2E+00

Key

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.

-- Route of exposure is not applicable to this medium.

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of the hazard quotients) for all routes of exposure for the future industrial worker exposed to groundwater used as process water. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) of greater than 1 indicates the potential for adverse noncancer effects. The estimated target organ HIs between 50 and 2 indicate that the potential for adverse effects could occur from exposure to contaminated groundwater containing benzene, naphthalene, and arsenic.

Table G-19

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Future
Receptor Population: Car Wash Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Indoor Air	Study Area	1,2-Dichloroethane	--	1E-05	--	1E-05
			Benzene	--	6E-03	--	6E-03
			Trichloroethene	--	3E-04	--	3E-04
						Groundwater Risk Total =	6E-03
						Total Risk =	6E-03

Key

-- Route of exposure is not applicable to this medium.

This table provides risk estimates for the significant routes of exposure for the future car wash worker. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of a car wash worker's exposure to groundwater, as well as the toxicity of the COCs (1,2-dichloroethene, benzene, and trichloroethene). The total risk from direct exposure to contaminated groundwater at this site to a future car wash worker is estimated to be 6×10^{-3}. The COCs contributing most to this risk level are benzene and trichloroethene. This risk level indicates that if no clean-up action is taken, an individual would have an increased probability of 6 in 1,000 of developing cancer as a result of site-related exposure to the COCs.

Table G-20

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Car Wash Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Indoor Air	Study Area	Ammonia	Respiratory	--	9E+01	--	9E+01
			Benzene	Immune System	--	7E+01	--	7E+01
			Naphthalene	Respiratory	--	5E+00	--	5E+00
							Groundwater Hazard Index Total =	2E+02
							Immune System Hazard Index =	7E+01
							Respiratory Hazard Index =	9E+01

Key

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.

-- Route of exposure is not applicable to this medium.

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of the hazard quotients) for all routes of exposure for the future car wash worker. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) of greater than 1 indicates the potential for adverse noncancer effects. The estimated target organ HIs of 90 and 5 indicate that the potential for adverse effects could occur from exposure to contaminated groundwater containing ammonia, benzene, and naphthalene.

Table G-21

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Wells G&H Superfund Site - Aberjona River Study - OU3 - Aberjona River Study Area
Medium: Surface Water

Chemical	Frequency of Detection	Maximum Detected Concentration[1] (μg/L)	Location of Maximum Detected Conc.	Screening Criterion (μg/L)	Type	COPC? [2]	Reason for Exclusion
Aluminum	6 / 133	37	IPSW-08-00-051602FT	87	Freshwater Chronic NAWQC	No	DF, BSV
Antimony	10 / 133	4	IPSW-09-051502FT	30	SCV	No	BSV
Arsenic	63 / 133	13	IPSW-05-051502FT	150	Freshwater Chronic NAWQC [3]	No	BSV
Barium	132 / 133	**63**	IPSW-08-091002FT	4	Tier II	Yes	
Beryllium	6 / 133	0.25	IPSW-08-00-072502FT	5.3	Tier II	No	DF, BSV
Cadmium	7 / 133	**0.31**	IPSW-09-042602FT	0.27	Freshwater Chronic NAWQC [4]	Yes	
Calcium	133 / 133	58,100	IPSW-05-111901FT	NA	NA	No	Nutrient
Chromium	62 / 133	2.9	IPSW-06-042602FT	83.7	Freshwater Chronic NAWQC [4,5]	No	BSV
Cobalt	29 / 133	2.1	IPSW-05-102502FT	3	Tier II	No	BSV
Copper	56 / 133	**52**	IPSW-06-042602FT	10.2	Freshwater Chronic NAWQC [4]	Yes	
Iron	69 / 133	**1,480**	IPSW-05-071401FT	1,000	Freshwater Chronic NAWQC	Yes	
Lead	8 / 133	**3.8**	IPSW-08-00-083102FT	3.0	Freshwater Chronic NAWQC [4]	Yes	
Magnesium	133 / 133	9,280	IPSW-05-111901FT	NA	NA	No	Nutrient
Manganese	118 / 133	**770**	SW-MC-13-0	80	Tier II	Yes	
Mercury	10 / 133	0.17	IPSW-06-080602FT	0.77	Freshwater Chronic NAWQC	No	BSV
Nickel	67 / 133	2.7	IPSW-09-071401FT	59	Freshwater Chronic NAWQC [4]	No	BSV
Potassium	132 / 132	7,690	IPSW-05-021502FT	NA	NA	No	Nutrient
Selenium	8 / 133	2.7	IPSW-05-062002FT	4.61	Freshwater Chronic NAWQC	No	BSV
Silver	7 / 133	**0.55**	IPSW-10-051502FT	0.12	Tier II	Yes	
Sodium	132 / 132	144,000	IPSW-06-021502FT	NA	NA	No	Nutrient
Thallium	7 / 133	3.6	IPSW-06-102502FT	12	SCV	No	BSV
Vanadium	14 / 133	2.0	IPSW-09-071401FT	19	Tier II	No	BSV
Zinc	105 / 133	121	IPSW-05-121701FT	134	Freshwater Chronic NAWQC [4]	No	BSV

Notes:

[1] Dissolved (filtered) concentrations.

[2] Analytes with maximum detected concentrations exceeding screening criteria were included as Chemicals of Potential Concern (COPCs).

[3] Value reported for arsenic $^{3+}$.

[4] Metals criteria were adjusted to a site-specific hardness value 116 mg/L as $CaCO_3$ using equations provided in USEPA, 2002.

[5] Value reported for chromium $^{3+}$, it is assumed that chromium in surface water is present in reduced form.

COPC - Chemical of Potential Concern

NAWQC - National Ambient Water Quality Criterion (USEPA 1986a,b; 1987; 1992a, 1998, 2002).

SCV - Secondary Chronic Value as presented in Suter and Tsao (1996).

Tier II - Ecotox Thresholds Great Lakes Water Quality Initiative Tier II Methodology (USEPA, 1996).

NA - Screening criterion Not Available

BSV - Below Screening Value

DF - Detection Frequency < 5%

A bolded value indicates that a maximum detected concentration exceeds screening benchmarks.

Table G-22

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Industri-Plex Superfund Site - Sitewide
Medium: Surface Water

Chemical	Frequency of Detection	Maximum Detected Concentration (ug/L)	Location of Maximum Detected Conc.	Screening Criterion (ug/L)	Type	COPC?	Reason for Exclusion
Benzene	2 / 10	190	SW-MC-05-10.8-D	46	Tier II	Yes	
Chlorobenzene	2 / 10	4.0	SW-MC-05-10.8-D	130	Tier II	No	BSV
cis-1,2-Dichloroethene	7 / 10	13	SW-MC-05-10.8-D	590	SCV	No	BSV
Toluene	1 / 10	4.0	SW-MC-06-0	130	Tier II	No	BSV
Trichloroethene	6 / 10	4.0	SW-MC-05-10.8-D	350	Tier II	No	BSV
Vinyl Chloride	2 / 10	3.0	SW-MC-05-10.8-D	NA	NA	Yes	
Xylene, m/p-	1 / 10	2.0	SW-MC-05-10.8-D	13	SCV	No	BSV
Anthracene	1 / 28	0.1	SW-09-IP	0.73	SCV	No	BSV/DF
Benzoic acid	3 / 9	69	SW-04-IP	42	SCV	Yes	
bis(2-Ethylhexyl)phthalate	1 / 28	120	SW-09-IP	32	Tier II	Yes	
Cyclohexanone	6 / 18	290	SW-04-IP	NA	NA	Yes	
Diethylphthalate	5 / 28	0.3	SW-09-IP	220	Tier II	No	BSV
Di-n-Butylphthalate	2 / 28	0.2	SW-04-IP	33	Tier II	No	BSV
Di-n-octylphthalate	1 / 28	0.3	SW-09-IP	NA	NA	No	DF
Fluoranthene	2 / 28	0.6	SW-09-IP	NA	NA	Yes	
Phenol	3 / 28	7	SW-04-IP	NA	NA	Yes	
Pyrene	2 / 28	0.4	SW-09-IP	NA	NA	Yes	
Aluminum	6 / 75	82	IPSW-02-010402FT	87	Freshwater Chronic NAWQC	No	BSV
Antimony	10 / 75	4.4	IPSW-02-111901FT	30	SCV	No	BSV
Arsenic	73 / 93	120	SW-MC-05-10.8-D	150	Freshwater Chronic NAWQC[2]	No	BSV
Barium	73 / 75	44.2	IPSW-02-111901FT	4	Tier II	Yes	
Beryllium	5 / 75	0.37	IPSW-04-00-072502FT	5.3	Tier II	No	BSV
Cadmium	6 / 75	0.84	IPSW-02-062002FT	0.34	Freshwater Chronic NAWQC[3]	Yes	
Chromium	44 / 75	10	SW-MC-05-10.8-D	109.5	Freshwater Chronic NAWQC[3,4]	No	BSV
Cobalt	28 / 75	5.0	SW-MC-07-9.8-D	3	Tier II	Yes	
Copper	38 / 75	7.4	IPSW-02-111901FT	13.5	Freshwater Chronic NAWQC[3]	No	BSV
Iron	61 / 75	27,000	SW-MC-05-10.8-D	1,000	Freshwater Chronic NAWQC	Yes	
Lead	9 / 75	1.4	IPSW-04-00-051602FT	4.2	Freshwater Chronic NAWQC[3]	No	BSV
Manganese	75 / 75	1,500	SW-MC-05-10.8-D	80	Tier II	Yes	
Mercury	6 / 75	0.10	IPSW-03-092502FT	0.77	Freshwater Chronic NAWQC	No	BSV
Nickel	52 / 75	7.0	SW-MC-05-10.8-D	78	Freshwater Chronic NAWQC[3]	No	BSV
Selenium	5 / 75	1.6	IPSW-04-00-092502FT	4.61	Freshwater Chronic NAWQC	No	BSV
Silver	5 / 75	0.40	IPSW-04-00-101802FT	0.36	SCV	Yes	
Thallium	6 / 75	2.7	IPSW-02-072502FT	12	SCV	No	BSV
Vanadium	12 / 75	19	SW-MC-05-10.8-D	19	Tier II	No	BSV
Zinc	73 / 75	380	SW-MC-05-0-S	177	Freshwater Chronic NAWQC[3]	Yes	
Supplemental Data Set							
Benzene[5]	54 / 67	2530	NML-8-09/04	46	Tier II	Yes	
Arsenic[5]	47 / 51	5043	NML-8-09/01	150	Freshwater Chronic NAWQC[2]	Yes	
Ammonia[6]	85 / 127	2110	NML-10-09/01	2.9	Freshwater Chronic NAWQC[7]	Yes	

Notes:

[1] *Analytes with maximum detected concentrations exceeding* screening criteria were included as Chemicals of Potential Concern (COPCs).

[2] Value reported for arsenic $^{3+}$.

[3] Metals criteria adjusted for hardness (161 mg/L as $CaCO_3$) using equations provided in USEPA, 2002.

[4] Value reported for chromium $^{3+}$, it is assumed that chromium in surface water is present in reduced form.

[5] Data set compiled for natural attenuation report presented in Appendix 2D of RI report. Benzene data from Tables 1 to 3 of Appendix G of natural attenuation report; Arsenic data from Tables D.4 and D.5 of natural attenuation report.

[6] Data set compiled for Technical Memorandum, Evaluation of Supplemental Data (TtNUS, 2005c). Ammonia data from Table 4.1 of the Technical Memorandum.

[7] Ammonia criterion adjusted for pH and temperature using equations provided in USEPA, 2002.

COPC - Chemical of Potential Concern

NAWQC - National Ambient Water Quality Criterion (*USEPA 1986a,b; 1987; 1992a, 1998, 2002*).

SCV - Secondary Chronic Value as presented in Suter and Tsao (1996).

Tier II - Ecotox Thresholds Great Lakes Water Quality Initiative Tier II Methodology (USEPA, 1996).

NA - Screening criterion Not Available

BSV - Below Screening Value

DF - Detection Frequency < 5%

Table G-23

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Wells G&H Superfund Site - Aberjona River Study - OU3 - Aberjona River Study Area
Medium: Sediment

Chemical	Frequency of Detection	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Conc.	Screening Criterion		COPC?[2]	Reason for Exclusion[3]
				Conc. (mg/kg)	Type[1]		
1,1,1-Trichloroethane	3 / 100	110	SD-TT-30-01-TR	na	na	No	DF
1,1,2-Trichloro-1,2,2-trifluoroethane	1 / 5	37.5	SD-UF-02-TR	na	na	No	LC
1,1-Dichloroethane	1 / 87	3	SD-18-01-FW	27	SCV	No	BSV/DF
1,2-Dichloroethene(total)	8 / 65	59	SD-18-01-FW	400	SCV	No	BSV
2-Butanone	22 / 71	290	SD-19-01-FW	270	SCV	Yes	
Acetone	22 / 81	7300	SD-TT-30-01-TR	8.7	SCV	Yes	
Benzene	8 / 87	22	SD-21-01-ME	57	SQB	No	BSV
Carbon Disulfide	3 / 63	29	SD-10-02-TR	0.85	SCV	No	DF
cis-1,2-Dichloroethene	18 / 28	562	SD-20-01-ME	400	SCV	Yes	
Ethylbenzene	4 / 87	9	SD-06-03-ME	3600	SQB	No	BSV/DF
Methyl Acetate	4 / 6	530	SD-TT-30-01-TR	na	na	No	LC
Methylene chloride	2 / 101	100	SD-22-03-FW	370	SCV	No	BSV/DF
Naphthalene	3 / 26	208	SD-21-01-ME	480	ERL	No	BSV
Tetrachloroethene	5 / 90	3164	SD-22-02-ME	530	SQB	Yes	
Toluene	3 / 63	22	SD-TT-30-01-TR	670	SQB	No	BSV/DF
trans-1,2-Dichloroethene	1 / 28	387	SD-11-01-ME	400	SCV	No	BSV/DF
Trichloroethene	18 / 91	2025	SD-20-01-ME	1600	SQB	Yes	
Vinyl chloride	2 / 87	255	SD-11-01-ME	na	na	No	DF
Xylene, m/p-	2 / 28	25	SD-06-03-ME	25	SQB	No	BSV
2-Methylnaphthalene	28 / 98	220	SD-09-06-FW	70	ERL	Yes	
Acenaphthene	39 / 99	520	SD-09-06-FW	620	SQC	No	BSV
Acenaphthylene	38 / 98	480	SD-07-10-FW	44	ERL	Yes	
Anthracene	55 / 99	1300	SD-06-03-FW	220	LEL	Yes	
Benzo(a)anthracene	85 / 109	9600	SD-07-10-ME	320	LEL	Yes	
Benzo(a)pyrene	84 / 106	10000	SD-07-10-ME	430	ERL	Yes	
Benzo(b)fluoranthene	95 / 116	16000	SD-07-10-ME	240	LEL[4]	Yes	

Table G-23

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Wells G&H Superfund Site - Aberjona River Study - OU3 - Aberjona River Study Area
Medium: Sediment

Chemical	Frequency of Detection	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Conc.	Screening Criterion		COPC?[2]	Reason for Exclusion[3]
				Conc. (mg/kg)	Type[1]		
Benzo(g,h,i)perylene	62 / 103	5300	SD-07-10-ME	170	LEL	Yes	
Benzo(k)fluoranthene	84 / 109	14000	SD-07-05-FW	240	LEL	Yes	
bis(2-ethylhexyl)phthalate	49 / 89	13000	SD-07-05-FW	890000	SCV	No	BSV
Butylbenzylphthalate	9 / 74	620	SD-07-05-FW	11000	SQB	No	BSV
Carbazole	19 / 74	680	SD-07-09-FW	na	na	Yes	
Chrysene	88 / 110	10000	SD-07-10-ME	340	LEL	Yes	
Di-n-octylphthalate	3 / 73	430	SD-07-05-FW	na	na	No	DF
Dibenz(a,h)anthracene	42 / 100	2000	SD-07-10-ME	60	LEL	Yes	
Dibenzofuran	8 / 72	500	SD-09-06-FW	2000	SQB[5]	Yes	
Diethylphthalate	1 / 72	240	SD-07-04-FW	567	SQB[6]	No	BSV/DF
Fluoranthene	102 / 116	23000	SD-07-10-ME	2900	SQC	Yes	
Fluorene	46 / 99	810	SD-09-06-FW	540	SQB	Yes	
Indeno(1,2,3-cd)pyrene	69 / 106	6900	SD-07-10-ME	200	LEL	Yes	
N-nitrosodiphenylamine	7 / 75	560	SD-10-01-FW	na	na	Yes	
Naphthalene	36 / 99	2500	SD-21-02-FW	480	SQB	Yes	
Phenanthrene	81 / 106	12000	SD-07-10-ME	850	SQC	Yes	
Pyrene	100 / 114	15000	SD-07-10-ME	660	ERL	Yes	
4,4'-DDD	74 / 111	310	SD-13-03-ME	8	LEL	Yes	
4,4'-DDE	91 / 115	160	SD-10-01-ME	5	LEL	Yes	
4,4'-DDT	62 / 104	47	SD-07-10-FW	1.6	ERL	Yes	
Aldrin	23 / 96	18	SD-10-01-ME	2	LEL	Yes	
alpha-BHC	14 / 98	2.7	SD-07-02-FW	6	LEL	No	BSV
alpha-Chlordane	71 / 111	93	SD-13-03-ME	7	LEL	Yes	
Aroclor-1248	26 / 103	560	SD-10-01-ME	30	LEL	Yes	
Aroclor 1254	10 / 103	2600	SD-JY-07	60	LEL	Yes	
Aroclor-1260	38 / 105	2400	SD-JY-07	5	LEL	Yes	

Table G-23

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Wells G&H Superfund Site - Aberjona River Study - OU3 - Aberjona River Study Area
Medium: Sediment

Chemical	Frequency of Detection	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Conc.	Screening Criterion Conc. (mg/kg)	Screening Criterion Type [1]	COPC?[2]	Reason for Exclusion [3]
beta-BHC	19 / 101	6.6	SD-07-07-FW	5	LEL	Yes	
delta-BHC	21 / 95	25	SD-06-03-FW	3	LEL [7]	Yes	
Dieldrin	54 / 103	20	SD-14-03-FW	52	SQC	No	BSV
Endosulfan I	23 / 105	68	SD-21-01-FW	2.9	SQB	Yes	
Endosulfan II	23 / 96	8.4	SD-07-09-FW	14	SQB	No	BSV
Endosulfan Sulfate	9 / 94	3.9	SD-07-04-FW	na	na	Yes	
Endrin	43 / 101	17	SD-06-03-ME	20	SQC	No	BSV
Endrin Aldehyde	34 / 97	27	SD-07-02-ME	na	na	Yes	
Endrin Ketone	4 / 93	2.9	SD-08-02-FW	na	na	No	DF
gamma-BHC (Lindane)	4 / 93	1.4	SD-07-02-FW	3.7	SQB	No	BSV/DF
gamma-Chlordane	66 / 108	650	SD-13-03-ME	0.5	ERL	Yes	
Heptachlor	12 / 93	1.6	SD-07-06-FW	68	SCV	No	BSV
Heptachlor Epoxide	21 / 96	4.9	SD-22-01-FW	5	LEL	No	BSV
Methoxychlor	3 / 93	12	SD-07-10-FW	19	SQB	No	BSV/DF
Aluminum	341 / 355	34400	SD-13-02-FW	25500	TEL	Yes	
Antimony	196 / 317	329	SD-TT-22-01	2	ERL	Yes	
Arsenic	338 / 353	4550	SD-12-03-ME	8.2	ERL	Yes	
Barium	339 / 355	3420	SD-WW-11	na	na	Yes	
Beryllium	280 / 351	2.9	SD-19-01-ME	na	na	Yes	
Cadmium	302 / 354	37.7	SD-01-06-FW	1.2	ERL	Yes	
Chromium	351 / 355	24600	SD-WW-08	81	ERL	Yes	
Cobalt	351 / 355	130	SD-CB-03-06	50	LEL*	Yes	
Copper	351 / 355	3760	SD-TT-30-03	34	ERL	Yes	
Cyanide	57 / 122	12.1	SD-WS-08	0.1	LEL*	Yes	
Iron	351 / 355	258000	SD-19-01-TR	20000	LEL	Yes	
Lead	351 / 355	41000	SD-TT-22-01	47	ERL	Yes	

Table G-23

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Wells G&H Superfund Site - Aberjona River Study - OU3 - Aberjona River Study Area
Medium: Sediment

Chemical	Frequency of Detection	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Conc.	Screening Criterion		COPC?[2]	Reason for Exclusion[3]
				Conc. (mg/kg)	Type[1]		
Manganese	351 / 355	3060	SD-UM-02	460	LEL	Yes	
Mercury	300 / 344	89.2	SD-TT-30-03	0.15	ERL	Yes	
Nickel	338 / 355	177	SD-CB-04-03	21	ERL	Yes	
Selenium	223 / 351	30.3	SD-12-03-ME	na	na	Yes	
Silver	104 / 320	11.5	SD-CB-04-02	0.5	LEL*	Yes	
Thallium	148 / 331	18.1	SD-BW-03	na	na	Yes	
Vanadium	341 / 355	180	SD-UM-02	na	na	Yes	
Zinc	350 / 355	8750	SD-CB-04-03	120	LEL	Yes	

Notes:

1 SCV, SQB, and SQCs based on 1% sediment organic carbon content; where SCV, SQBs and SQCs are used, sediment organic carbon content was greater than 1%, unless indicated otherwise

2 Analytes with maximum detected concentrations exceeding screening criteria were included in the BERA.

3 Reasons for exclusion were that the maximum level was below the screening value (BSV) and/or the frequency of detection was less than or equal to 5% (DF).

4 Screening value for benzo(k)fluoranthene

5 Organic carbon content at SD-09-06-FW was 0.1%; if the SQB were adjusted based on 0.1% organic carbon content, the maximum level of dibenzofuran would be greater than the screening criterion.

6 SQB was adjusted downward for organic carbon content at SD-01-07-FW (0.9%)

7 Value for BHC in Persaud*et al.* (1993)

DF - detection frequency
BSV - below screening value
LC - laboratory contaminant
ERL - NOAA Effects Range-Low (Long*et al.*, 1995; Long and Morgan, 1990)
SCV - Secondary Chronic Value (Jones*et al.*, 1997)
SQC - USEPA Sediment Quality Criterion (USEPA, 1993 b,c) - used for endrin and dieldrin only
SQB - USEPA Office of Solid Waste and Emergency Response Sediment Quality Benchmark (USEPA, 1996)

Table G-23

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Wells G&H Superfund Site - Aberjona River Study - OU3 - Aberjona River Study Area
Medium: Sediment

Chemical	Frequency of Detection	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Conc.	Screening Criterion		COPC?[2]	Reason for Exclusion[3]
				Conc. (mg/kg)	Type[1]		

LEL - Ontario Ministry of Environment and Energy Lowest Effect Level (Persaud *et al.*, 1993)
LEL*- Ontario Ministry of Environment and Energy Lowest Effect Level (OME, 1996)
TEL - Threshold Effects Level (Buchman, 1999)
na - not available

Table G-24

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Industri-Plex Superfund Site - Sitewide
Medium: Sediment

Chemical	Frequency of Detection	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Conc.	Screening Criterion Conc. (mg/kg)	Screening Criterion Type [1]	COPC? [2]	Reason for Exclusion [3]
1,1-Dichloroethane	2 / 8	0.045	SD-MC-07	0.027	SCV	Yes	
2-Butanone	3 / 8	0.52	SD-MC-05	0.27	SCV	Yes	
Acetone	8 / 8	2.3	SD-MC-05	0.0087	SCV	Yes	
Benzene	4 / 8	46	SD-MC-05	0.057	SQB	Yes	
Carbon Disulfide	4 / 8	0.060	SD-MC-05	0.00085	SCV	Yes	
Chlorobenzene	1 / 8	0.026	SD-MC-05	0.82	SQB	No	BSV
cis-1,2-Dichloroethene	3 / 8	0.036	SD-MC-05	0.40	SCV	No	BSV
Ethylbenzene	1 / 8	0.50	SD-MC-05	3.6	SQB	No	BSV
Toluene	1 / 8	0.093	SD-MC-05	0.67	SQB	No	BSV
Trichloroethene	2 / 8	0.016	SD-MC-05	1.6	SQB	No	BSV
Vinyl Chloride	1 / 8	0.013	SD-MC-05	na	na	Yes	
Xylene, m/p-	1 / 8	2.4	SD-MC-05	0.025	SQB	Yes	
Xylene, o-	1 / 8	0.30	SD-MC-05	0.16	SCV	Yes	
2-Methylphenol	1 / 8	0.38	SD-MC-05	0.012	SCV	Yes	
Acenaphthene	5 / 8	0.80	SD-MC-05	0.62	SQC	Yes	
Acenaphthylene	3 / 8	0.11	SD-MC-13	0.044	ERL	Yes	
Anthracene	6 / 8	1.2	SD-MC-05	0.22	LEL	Yes	
Benzo(a)anthracene	8 / 8	4.9	SD-MC-05	0.32	LEL	Yes	
Benzo(a)pyrene	8 / 8	7.2	SD-MC-11	0.43	ERL	Yes	
Benzo(b)fluoranthene	8 / 8	10	SD-MC-05	0.24	LEL [4]	Yes	
Benzo(g,h,i)perylene	8 / 8	4.1	SD-MC-05	0.17	LEL	Yes	
Benzo(k)fluoranthene	8 / 8	8.3	SD-MC-05	0.24	LEL	Yes	
bis(2-Ethylhexyl)phthalate	8 / 8	37	SD-MC-06	890	SCV	No	BSV
Butylbenzylphthalate	1 / 8	0.14	SD-MC-13	11	SQB	No	BSV
Carbazole	6 / 8	2.1	SD-MC-05	na	na	Yes	
Chrysene	8 / 8	10	SD-MC-05	0.34	LEL	Yes	

Table G-24

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Industri-Plex Superfund Site - Sitewide
Medium: Sediment

Chemical	Frequency of Detection	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Conc.	Screening Criterion Conc. (mg/kg)	Screening Criterion Type [1]	COPC?[2]	Reason for Exclusion [3]
Dibenz(a,h)anthracene	8 / 8	1.2	SD-MC-11	0.060	LEL	Yes	
Dibenzofuran	4 / 8	0.83	SD-MC-05	2.0	SQB	No	BSV
Diethylphthalate	2 / 8	0.46	SD-MC-11	0.63	SQB	No	BSV
Fluoranthene	8 / 8	19	SD-MC-05	2.9	SQC	Yes	
Fluorene	5 / 8	1.3	SD-MC-05	0.54	SQB	Yes	
Indeno(1,2,3-cd)pyrene	8 / 8	5.2	SD-MC-05	0.20	LEL	Yes	
Naphthalene	5 / 8	0.83	SD-MC-05	0.48	SQB	Yes	
N-Nitrosodiphenylamine	4 / 8	0.17	SD-MC-11	na	na	Yes	
Phenanthrene	8 / 8	10	SD-MC-05	0.85	SQC	Yes	
Phenol	2 / 8	0.55	SD-MC-05	na	na	Yes	
Pyrene	8 / 8	14	SD-MC-11	0.66	ERL	Yes	
4,4'-DDD	3 / 8	0.022	SD-MC-06	0.0080	LEL	Yes	
4,4'-DDE	2 / 8	0.017	SD-MC-13	0.0050	LEL	Yes	
4,4'-DDT	1 / 8	0.013	SD-MC-13	0.0016	ERL	Yes	
alpha-Chlordane	1 / 8	0.092	SD-MC-06	0.0070	LEL	Yes	
gamma-Chlordane	1 / 8	0.093	SD-MC-06	0.00050	ERL	Yes	
Aluminum	68 / 68	19,900	AR04	25,500	TEL	No	BSV
Antimony	37 / 51	20	AR04	2	ERL	Yes	
Arsenic	68 / 68	2,390	SD-MC-07	8.2	ERL	Yes	
Barium	68 / 68	227	HB02-12	na	na	Yes	
Beryllium	52 / 68	2.0	HB02-03	na	na	Yes	
Cadmium	67 / 68	45	HB02-10	1.2	ERL	Yes	
Chromium	68 / 68	1,120	AR04	81	ERL	Yes	
Cobalt	68 / 68	136	HB02-03	50	LEL*	Yes	
Copper	68 / 68	2,000	HB01-05	34	ERL	Yes	

Table G-24

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Industri-Plex Superfund Site - Sitewide
Medium: Sediment

Chemical	Frequency of Detection	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Conc.	Screening Criterion		COPC?[2]	Reason for Exclusion[3]
				Conc. (mg/kg)	Type[1]		
Iron	68 / 68	233,000	HB02-11	20000	LEL	Yes	
Lead	68 / 68	672	HB01-04	47	ERL	Yes	
Manganese	68 / 68	3,900	HB02-11	460	LEL	Yes	
Mercury	59 / 65	3.8	SD-MC-09	0.15	ERL	Yes	
Nickel	68 / 68	55	HB02-03	21	ERL	Yes	
Selenium	65 / 68	20	AR04	na	na	Yes	
Silver	55 / 68	19	AR05	0.5	LEL*	Yes	
Thallium	31 / 51	18	HB02-11	na	na	Yes	
Vanadium	68 / 68	84	HB02-17	na	na	Yes	
Zinc	68 / 68	12,900	HB01-08	150	ERL	Yes	
Chromium VI	68 / 68	12	AR04	na	na	Yes	

Notes:

[1] SCVs, SQBs, and SQCs based on 1% sediment organic carbon content; actual sediment organic carbon content is greater than 1% at all sample locations.

[2] Analytes with maximum detected concentrations exceeding screening criteria were included in the BERA.

[3] Reasons for exclusion were that the maximum detected level was below the screening value (BSV) and/or the frequency of detection was less than or equal to 5% (DF).

[4] Screening value for benzo(k)fluoranthene

DF - detection frequency
BSV - below screening value
COPC - Contaminant of potential ecological concern
ERL - NOAA Effects Range-Low (Long*et al.*, 1995; Long and Morgan, 1990)
SCV - Secondary Chronic Value (Jones*et al.*, 1997)
SQC - USEPA Sediment Quality Criterion (USEPA, 1996)
SQB - USEPA Office of Solid Waste and Emergency Response Sediment Quality Benchmark (USEPA, 1996)

Table G-24

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Industri-Plex Superfund Site - Sitewide
Medium: Sediment

Chemical	Frequency of Detection	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Conc.	Screening Criterion		COPC?[2]	Reason for Exclusion[3]
				Conc. (mg/kg)	Type[1]		

LEL - Ontario Ministry of Environment and Energy Lowest Effect Level (Persaud *et al.*, 1993)
LEL*- Ontario Ministry of Environment and Energy Lowest Effect Level (OME, 1996)
TEL - Threshold Effects Level (Buchman, 1999)
na - not available

Table G-25

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Industri-Plex Superfund Site - A6 and HB03 areas
Medium: Soil

Chemical	Frequency of Detection	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Conc.	Screening Criterion Conc. (mg/kg)	Screening Criterion Type [1]	COPC?[2]	Reason for Exclusion[3]
Aluminum	23 / 23	6530	A612 (0-1)	na	na	Yes	pH[4]
Antimony	14 / 23	50	A608 (0-1)	0.248	Mammal	Yes	
Arsenic	23 / 23	719	A608 (0-1)	0.25	Mammal	Yes	
Barium	23 / 23	535	A608 (0-1)	17.2	Avian	Yes	
Beryllium	10 / 23	0.30	HB04-02 (0-0.5)	2.42	Mammal	No	BSV
Cadmium	17 / 19	2.3	A607 (0-1)	0.38	SSL (Mammal	Yes	
Chromium	23 / 23	2680	A610 (0-1)	0.4	Mammal	Yes	
Cobalt	23 / 23	11	A608 (0-1)	13	SSL (Phyto)	No	BSV
Copper	23 / 23	611	A608 (0-1)	38.9	Avian	Yes	
Iron	23 / 23	66900	A608 (0-1)	na	na	Yes	pH[5]
Lead	23 / 23	5200	A608 (0-1)	0.94	Avian	Yes	
Manganese	23 / 23	353	A606 (0-1)	322	Mammal	Yes	
Mercury	21 / 23	9.6	A608 (0-1)	0.1	Earthworm	Yes	
Nickel	23 / 23	17	A611 (0-1)	30	Phyto	No	BSV
Selenium	12 / 23	7.6	A608 (0-1)	0.331	Avian	Yes	
Silver	8 / 23	17	A608 (0-1)	2	Phyto	Yes	
Thallium	19 / 23	42	A608 (0-1)	0.027	Mammal	Yes	
Vanadium	23 / 23	37	A611 (0-1)	0.714	Mammal	Yes	
Zinc	23 / 23	901	A610 (0-1)	12	Mammal	Yes	
Chromium VI	15 / 23	45	A610 (0-1)	12	Mammal	Yes	

Notes:

[1] Value in parentheses indicates the depth interval of soil core.

[2] Analytes with maximum detected concentrations exceeding screening criteria were included in the BERA.

[3] Reasons for exclusion were that the maximum detected level was below the screening value (BSV) and/or the frequency of detection was less than or equal to 5% (DF).

[4] Aluminum is identified as a COPC only for soils with a pH <5.5 (EPA, 2003b). Because soil pH data was not available for this location, aluminum was retained as a COPC.

[5] At soil pH values between 5 and 8, iron is generally not toxic (EPA, 2003b). Because soil pH data was not available for this location, iron was retained as a COPC.

DF - detection frequency
BSV - below screening value
COPC - Contaminant of potential ecological concern
SSL - EPA Interim Final Ecological Soil Screening Level (EPA 2003b)
Mammal - benchmark based on lowest mammalian value (Sample, Opresko, & Suter, 1996)
Avian - benchmark based on lowest avian value (Sample et al., 1996)
Earthworm - benchmark based on toxicity concentrations for earthworm (Efroymson, et al., 1997a)
Phyto - benchmark based on phytoxicity value (Efroymson, et al. 1997b)
na - not available

Table G-26

Ecological Exposure Pathways of Concern

Exposure Medium	Sensitive Environment Flag Y or N	Receptor	Endangered/ Threatened Species Flag Y or N	Exposure Routes	Assessment Endpoints	Measurement Endpoints
Sediment	N	Benthic Invertebrates	N	Ingestion and direct contact with chemicals in sediment	Sustainability (survival, growth, reproduction) of local populations of benthic invertebrates	- Comparison of sediment COPC concentrations to benchmarks - Toxicity of sediment to *Hyallela azteca* and *Chironomus tentans* - Comparison of tissue COPC concentration of invertebrates to reference locations - Multivariate analysis of benthic invertebrate community compositon
Surface Water	N	Aquatic invertebrates and warmwater fish populations	N	Ingestion and direct contact with chemicals in surface water	Sustainability (survival, growth, reproduction) of aquatic life	- Comparison of surface water COPC concentrations to criteria/benchmarks
				Direct and dietary exposures of COPCs in surface water	Sustainability (survival, growth, reproduction) of warmwater fish populations	- Comparison of tissue COPC concentration of fish to reference locations - Comparison of tissue concentrations with fish tissue benchmarks - Evaluation of population statistics to reference locations
Soil	N	Small terrestrial mammals	N	Ingestion of chemicals in soil	Sustainability (survival, growth, reproduction) of local populations of small terrestrial mammals	- Comparison of soil COPC concentrations to benchmarks - Comparison of estimated dietary doses in insectivorous wildlife with TRVs
Surface Water/Sediment/ Biota	N	Muskrat	N	Dietary exposures of COPCs	Sustainability (survival, growth, reproduction) of local populations of semi-aquatic mammals	- Comparison of estimated dietary doses in herbivorous mammals with TRVs
Surface Water/Sediment/ Biota	N	River Otter[1]	N	Dietary exposures of COPCs	Sustainability (survival, growth, reproduction) of local populations of small terrestrial mammals	- Comparison of estimated dietary doses in piscivorous mammals with TRVs
Surface Water/Sediment/ Biota	N	Mallard	N	Dietary exposures of COPCs	Sustainability (survival, growth, reproduction) of local populations of small terrestrial mammals	- Comparison of estimated dietary doses in omnivorous waterfowl with TRVs
Surface Water/Sediment/ Biota	N	Green Heron	N	Dietary exposures of COPCs	Sustainability (survival, growth, reproduction) of local populations of small terrestrial mammals	- Comparison of estimated dietary doses in predatory birds with TRVs

Notes:

(1) River otter evaluated for the Norther Study Area, only.
COPC - Chemical of Potential Concern
TRVs - Toxicity reference values

Table G-27

SUMMMARY OF RISK CONCLUSIONS FOR COMBINED STUDY AREAS

	INCREASING LEVEL OF RISK FROM NEGLIGIBLE TO HIGH → → → → → → →					Ecological Significance [1]						
Receptor/ Endpoint	Negligible Risk Potential Low Uncertainty	Low Risk Potential Increased Uncertainty	Moderate Risk High Uncertatinty	Moderate/High Risk Decreased Uncertainty	High Level of Impacts Low Uncertainty	Endangered or sensitive species[2]	Magnitude of the effect and level of biological organization affected[3]	Likelihood the effect will occur or continue[4]	Relative importance of the affected area to the surrounding habitat[5]	Extent to which the affected area is highly sensitive or ecologically unique[6]	Recovery potential of the affected receptor and chemical persistence[7]	**Unacceptable Ecological Risk[15]**
Muskrat			Moderate risk - arsenic in diet in Reaches 0, 1 & 2. Modeling with high uncertainty. Uncertain population effects.			No	U / L[8, 9]	L	U / M[10]	U / M	U / M[11]	No
River Otter		Low risk. Modeling with moderate uncertainty.				No	n / a	n / a	n / a	n / a	n / a	No
Green Heron	Negligible Risk Potential Low Uncertainty.					No	n / a	n / a	n / a	n / a	n / a	No
Mallard		Low risk due to metals in limited area of Reach 1. Modeling with moderate uncertainty.				No	U / L[8, 9]	L	U / L[10]	U / L	U / L[11]	No
Northern Short-tailed Shrew		Low risk - arsenic in diet. Modeling with high uncertainty. Uncertain population effects.				No	U / L[8, 9]	L	U / L[10]	L	U / L[11]	No
Warmwater fish populations	Reaches 2 to 6 with low risk based on tissue data. Uncertain risk in Reach 1.	HBHA Pond and HBHA Wetlands with low risk based on tissue arsenic data. Some exceedences of tissue benchmarks. Uncertain population effects.				No	L[9, 12]	L	U / L[10]	L	L[13]	No
Benthic Invertebrate Communities		HBHA wetland and Reaches 1 & 2 with Low/uncertain toxicity and communtiy impairment.		HBHA Pond with high risk based on severe toxicity and community impairment. High tissue metals.		No	U / M[9, 14]	L	L	L	L[13]	Yes

RATING: L = LOW, M = MODERATE, H = HIGH, U = UNCERTAIN, n / a = NEGLIGIBLE RISK, or not applicable

NOTES:

1 Ecological significance is defined in USEPA (1997) or OSWER Directive 9285.7-28, "Ecological Risk Assessment and Risk Management Principles for Superfund Sites," dated October 7, 1999. The six categories address the factors recommended in the OSWER guidance to be considered in evaluating the significance of ecological effects. The magnitude of the potential risk was considered in evaluating the significance of each factor; a low risk to the receptor *generally equates to low ecological significance.*

2 No endangered species were identified. The affected populations do not represent other known species with sensitivity to the chemical of potential concern (arsenic).

3 The magnitude of the observed or predicted ecological effects and level of biological organization affected (individual, local population, or community).

4 *The likelihood that effects will occur or continue* in terms of bioaccumulation or biomagnification into the food chain.

5 The extent to which the affected area is important to the functioning of the surrounding habitat (e.g., wildlife migration corridor, overwintering habitat, etc.).

6 The degree to which the affected area itself (directly) represents highly sensitive or ecologically unique (essential) habitat to the receptor population (e.g., nursery habitat).

7 The likelihood an affected receptor will not recover from the effect of site releases (i.e., species has long generation time or limited foraging range, chemical persistance in the environment).

8 There is high uncertainty in the magnitude of risk because it was estimated using modeling methods without any direct measure of effect (no model verification).

9 Loss of individuals or effects on reproduction may be mitigated in the affected area by immigration from nearby habitats (recruitment from the regional population).

10 Halls Brook and the Aberjona River could function as migration corridors to wildlife and fish, however, it is uncertain whether they are used for this purpose.

11 Receptor has generation time that is moderately short, sediment arsenic is persistent in the affected area, *but not fully bioavailable because of chelation to iron.*

12 No population effect was detected in Reaches 1 to 6 based on tissue data, however, no fish tissue samples were collected in Reach 1. Tissue concentrations of arsenic exceeded benchmarks in Reach 0. Population effects uncertain in Reach 0.

13 Receptor has *generation time that is short (invertebrates) or moderately* short (fish), sediment arsenic is persistent in the affected area, but not fully bioavailable because of chelation to iron.

14 Triad analysis (chemical, biological, and ecological field sampling) identified a high magnitude of effect in the HBHA Pond, however, downgradient of the pond there was lower community effects associated with higher uncertainty.

15 Unacceptable Risk is defined in USEPA (see footnote 1) as a predicted impact to a local population or community of sufficient magnitude, severity, areal extent, and duration that they will not be able to recover and/or maintain themselves in a healthy state. Additionally, these effects are predicted to exceed the natural variation in similar reference areas.

Table G-28

COC Concentrations Expected to Provide Adequate Protection of Ecological Receptors

Habitat Type/Name	Exposure Medium	COC	Protective Level	Units	Basis	Assessment Endpoint
HBHA Pond	Sediment	Arsenic	273	mg/kg	Site-Specific LOAEL	Sustainability (survival, growth, reproduction) of local populations of benthic invertebrates
	Surface Water	Arsenic	150	ug/L	NRWQC[1]	Sustainability (survival, growth, reproduction) of populations of aquatic organisms including invertebrates and fish
		Benzene	46	ug/L	Tier II Benchmark[2]	Sustainability (survival, growth, reproduction) of populations of aquatic organisms including invertebrates and fish
		Ammonia	NRWQC, pH and temperature dependent	ug/L	NRWQC[3]	Sustainability (survival, growth, reproduction) of populations of aquatic organisms including invertebrates and fish

Notes:

(1) The NRWQC value is selected as the surface water PRG

(2) The TIER II value is selected as the surface water PRG

(3) The NRWQC value is selected as the surface water PRG for ammonia and is calculated based on an adjustment for pH and temperature; tables and formulas provided in EPA (2002) should be used to calculate the appropriate value.

COC - Chemical of Concern

LOAEL - Lowest Observable Adverse Effect Level

NRWQC - National Recommended Water Quality Criterion (EPA, 2002)

Tier II - Great Lakes Water Quality Initiave Tier II methodology (Suter and Tsao, 1996)

TABLE K-1
COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR SURFACE SOILS
RECORD OF DECISION
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

	Alternative SS-1: No Action	Alternative SS-2: Monitoring with Institutional Controls	Alternative SS-3: Permeable Cover and Monitoring with Institutional Controls	Alternative SS-4: Excavation and Off-Site Disposal	Alternative SS-5: Excavation, Treatment, and On-Site Reuse
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	□ - No Protection, ◘ - Partially Protective, ■ - Protective				
Protection of Human Health	□	◘	■	■	■
Ecological Protection	NA	NA	NA	NA	NA
COMPLIANCE WITH ARARs	□ - Does Not Meet, ◘ - May Not Meet/Partially Meets, ■ - Meets				
Chemical-Specific ARARs	NA	NA	NA	NA	NA
Location-Specific ARARs	NA	■	■	■	■
Action-Specific ARARs	NA	■	■	■	■
Other Criteria, Advisories, Guidance	□	■	■	■	■
LONG-TERM EFFECTIVENESS AND PERMANENCE	□ - No Protection, ◘ - Partially Protective, ■ - Protective				
Magnitude of Residual Risk - Human Health:	□	■	■	■	■
Magnitude of Residual Risk - Ecological:	■	■	■	■	■
Adequacy and Reliability of Controls	□	◘	◘	■	■
REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT	□ - Low or Reversible, ◘ - Moderate or Moderately Reversible, ■ - High or Irrreversible				
Treatment/Recycling Processes Utilized	□	□	□	□	■
Amount of Hazardous Materials Destroyed or Treated	□	□	□	□	■
Degree of Expected Reductions in Toxicity, Mobility or Volume:	□	□	□	□	■
Irreversibility	□	□	□	□	■
Type and Quantity of [Process] Residuals	□	□	□	□	◘
SHORT-TERM EFFECTIVENESS	□ - High Impacts, ◘ - Moderate Impacts, ■ - Low Impacts				
Protection of Community and Workers During Remedial Actions	■	■	■	■	■
Environmental Impacts	■	■	◘	◘	◘
Time Until Remedial Action Objectives are Achieved	□	■	■	■	■
IMPLEMENTABILITY	□ - High Effort or Low Reliability, ◘ - Moderate Effort or Moderate Reliability, ■ - Low Effort or High Reliability				
Ability to Construct and Operate the Technology	■	■	□	□	□
Reliability of the Technology	□	□	◘	■	■
Ease of Undertaking Additional Remedial Actions, if Necessary	■	■	□	■	■
Ability to Monitor Effectiveness of the Remedy	□	◘	◘	■	■
Ability to Obtain Approvals from Other Agencies	■	■	■	■	■
Coordination with Other Agencies	■	■	■	■	■
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	■	■	■	■	■
Availability of Necessary Equipment and Specialists	■	■	■	■	□
Availability of Prospective Technologies	■	■	■	■	□
COST					
Capital	$0	$185,000	$5,329,000	$47,172,000	$22,993,000
O&M	$0	$30,000/yr	$48,000/yr	$0	$0
Present Worth	$0	$600,000	$5,992,000	$47,172,000	$22,993,000

TABLE K-2
COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR SUBSURFACE SOILS
RECORD OF DECISION
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

	Alternative SUB-1: No Action	Alternative SUB-2: Monitoring with Institutional Controls	Alternative SUB-3: Permeable Cover and Monitoring with Institutional Controls
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	□ - No Protection, ◘ - Partially Protective, ■ - Protective		
Protection of Human Health	□	■	■
Ecological Protection	NA	NA	NA
COMPLIANCE WITH ARARs	□ - Does Not Meet, ◘ - May Not Meet/Partially Meets, ■ - Meets		
Chemical-Specific ARARs	NA	NA	NA
Location-Specific ARARs	NA	■	■
Action-Specific ARARs	NA	■	■
Other Criteria, Advisories, Guidance	□	■	■
LONG-TERM EFFECTIVENESS AND PERMANENCE	□ - No Protection, ◘ - Partially Protective, ■ - Protective		
Magnitude of Residual Risk - Human Health:	□	■	■
Magnitude of Residual Risk - Ecological:	■	■	■
Adequacy and Reliability of Controls	□	◘	■
REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT	□ - Low or Reversible, ◘ - Moderate or Moderately Reversible, ■ - High or Irrreversible		
Treatment/Recycling Processes Utilized	□	□	□
Amount of Hazardous Materials Destroyed or Treated	□	□	□
Degree of Expected Reductions in Toxicity, Mobility or Volume:	□	□	□
Irreversibility	□	□	□
Type and Quantity of [Process] Residuals	□	□	□
SHORT-TERM EFFECTIVENESS	□ - High Impacts, ◘ - Moderate Impacts, ■ - Low Impacts		
Protection of Community and Workers During Remedial Actions	■	■	■
Environmental Impacts	■	■	□
Time Until Remedial Action Objectives are Achieved	□	■	◘
IMPLEMENTABILITY	□ - High Effort or Low Reliability, ◘ - Moderate Effort or Moderate Reliability, ■ - Low Effort or High Reliability		
Ability to Construct and Operate the Technology	■	■	□
Reliability of the Technology	□	■	■
Ease of Undertaking Additional Remedial Actions, if Necessary	■	■	□
Ability to Monitor Effectiveness of the Remedy	□	■	■
Ability to Obtain Approvals from Other Agencies	■	■	■
Coordination with Other Agencies	■	■	■
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	■	■	■
Availability of Necessary Equipment and Specialists	■	■	■
Availability of Prospective Technologies	■	■	■
COST			
Capital	$0	$315,000	$6,495,000
O&M	$0	$108,000 (Years 1-10) $30,000 (Years 11-30)	$159,000 (Years 1-10) $81,000 (Years 11-30)
Present Worth	$0	$1,276,000	$8,070,000

TABLE K-3
COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR GROUNDWATER
RECORD OF DECISION
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

	Alternative GW-1: No Action	Alternative GW-2: Pond Intercept with Monitoring and Institutional Controls	Alternative GW-3: Plume Intercept by Groundwater Extraction, Treatment and Discharge and Monitoring with Institutional Controls	Alternative GW-4: Plume Intercept by In-Situ Groundwater Treatment and Monitoring with Institutional Controls
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	☐ - No Protection, ◘ - Partially Protective, ■ - Protective			
Protection of Human Health	☐	◘	■	■
Ecological Protection	☐	☐	■	■
COMPLIANCE WITH ARARs	☐ - Does Not Meet, ◘ - May Not Meet/Partially Meets, ■ - Meets			
Chemical-Specific ARARs	NA	◘	■	■
Location-Specific ARARs	NA	■	■	■
Action-Specific ARARs	NA	■	■	■
Other Criteria, Advisories, Guidance	☐	■	■	■
LONG-TERM EFFECTIVENESS AND PERMANENCE	☐ - No Protection, ◘ - Partially Protective, ■ - Protective			
Magnitude of Residual Risk - Human Health:	☐	◘	◘	◘
Magnitude of Residual Risk - Ecological:	☐	◘	■	■
Adequacy and Reliability of Controls	☐	◘	■	◘
REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT	☐ - Low or Reversible, ◘ - Moderate or Moderately Reversible, ■ - High or Irreversible			
Treatment/Recycling Processes Utilized	☐	◘	■	■
Amount of Hazardous Materials Destroyed or Treated	☐	◘	■	■
Degree of Expected Reductions in Toxicity, Mobility or Volume:	☐	◘	■	■
Irreversibility	☐	◘	■	◘
Type and Quantity of [Process] Residuals	☐	◘	☐	◘
SHORT-TERM EFFECTIVENESS	☐ - High Impacts, ◘ - Moderate Impacts, ■ - Low Impacts			
Protection of Community and Workers During Remedial Actions	■	■	■	■
Environmental Impacts	■	◘	◘	◘
Time Until Remedial Action Objectives are Achieved	☐	◘	■	■
IMPLEMENTABILITY	☐ - High Effort or Low Reliability, ◘ - Moderate Effort or Moderate Reliability, ■ - Low Effort or High Reliability			
Ability to Construct and Operate the Technology	■	■	☐	☐
Reliability of the Technology	☐	■	■	☐
Ease of Undertaking Additional Remedial Actions, if Necessary	■	■	◘	☐
Ability to Monitor Effectiveness of the Remedy	☐	■	■	■
Ability to Obtain Approvals from Other Agencies	■	■	■	■
Coordination with Other Agencies	■	■	■	■
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	■	■	■	■
Availability of Necessary Equipment and Specialists	■	■	■	☐
Availability of Prospective Technologies	■	■	■	☐
COST				
Capital	$0	$432,000	$4,739,000	$13,089,000
O&M	$0	$410,000 (yr 1-5) $205,500 (yr 6-30)	$1,297,500 (yr 1-2) $1,040,000 (yr 3-30)	$444,000 (yr 1-5) $222,000 (yr 6-30)
Present Worth	$0	$3,918,000	$19,137,000	$17,792,000

TABLE K-4
COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR HBHA POND SEDIMENTS
RECORD OF DECISION
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

	Alternative HBHA-1: No Action	Alternative HBHA-2: Monitoring	Alternative HBHA-3: Subaqueous Cap	Alternative HBHA-4: Storm Water Bypass and Sediment Retention with Partial Dredging and Providing Alternate Habitat	Alternative HBHA-5: Removal and Off-Site Disposal
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	□ - No Protection, ◘ - Partially Protective, ■ - Protective				
Protection of Human Health	□	□	◘	■	■
Ecological Protection	□	□	◘	■	■
COMPLIANCE WITH ARARs	□ - Does Not Meet, ◘ - May Not Meet/Partially Meets, ■ - Meets				
Chemical-Specific ARARs	□	□	■	◘	■
Location-Specific ARARs	NA	NA	■	■	■
Action-Specific ARARs	NA	NA	■	■	■
Other Criteria, Advisories, Guidance	□	□	■	◘	■
LONG-TERM EFFECTIVENESS AND PERMANENCE	□ - No Protection, ◘ - Partially Protective, ■ - Protective				
Magnitude of Residual Risk - Human Health:	□	□	■	■	■
Magnitude of Residual Risk - Ecological:	□	□	◘	◘	■
Adequacy and Reliability of Controls	□	□	◘	◘	■
REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT	□ - Low or Reversible, ◘ - Moderate or Moderately Reversible, ■ - High or Irreversible				
Treatment/Recycling Processes Utilized	□	□	□	◘	◘
Amount of Hazardous Materials Destroyed or Treated	□	□	□	◘	◘
Degree of Expected Reductions in Toxicity, Mobility or Volume:	□	□	□	◘	◘
Irreversibility	□	□	□	■	■
Type and Quantity of [Process] Residuals	□	□	□	◘	◘
SHORT-TERM EFFECTIVENESS	□ - High Impacts, ◘ - Moderate Impacts, ■ - Low Impacts				
Protection of Community and Workers During Remedial Actions	□	■	■	■	■
Environmental Impacts	■	◘	□	□	□
Time Until Remedial Action Objectives are Achieved	□	□	■	■	■
IMPLEMENTABILITY	□ - High Effort or Low Reliability, ◘ - Moderate Effort or Moderate Reliability, ■ - Low Effort or High Reliability				
Ability to Construct and Operate the Technology	■	■	□	◘	◘
Reliability of the Technology	□	□	◘	◘	■
Ease of Undertaking Additional Remedial Actions, if Necessary	■	■	□	◘	■
Ability to Monitor Effectiveness of the Remedy	□	■	◘	■	■
Ability to Obtain Approvals from Other Agencies	■	■	■	■	■
Coordination with Other Agencies	■	■	■	■	■
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	■	■	■	■	■
Availability of Necessary Equipment and Specialists	■	■	□	◘	◘
Availability of Prospective Technologies	■	■	□	■	■
COST					
Capital	$0	$0	$3,160,000	$4,833,000	$3,560,000
O&M	$0	$144,000/yr 1-2 $70,000 yr 3-30	$144,000/yr	$144,000/yr $1,136,500 (every 5 yrs)	$95,000/yrs 1-3 only
Present Worth	$0	$1,201,000	$5,291,000	$8,237,000	$3,810,000

NOTE: The effectiveness of HBHA-2, HBHA-3, and HBHA-5 assume that contaminated groundwater discharges to the HBHA Pond will be eliminated. This assumption is not necessary for HBHA-4.

TABLE K-5
COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR NEAR-SHORE SEDIMENTS
RECORD OF DECISION
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

	Alternative NS-1: No Action	Alternative NS-2: Institutional Controls	Alternative NS-3: Monitoring with Institutional Controls	Alternative NS-4: Removal and Off-Site Disposal
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	□ - No Protection, ◘ - Partially Protective, ■ - Protective			
Protection of Human Health	□	◘	◘	■
Ecological Protection	NA	NA	NA	NA
COMPLIANCE WITH ARARs	□ - Does Not Meet, ◘ - May Not Meet/Partially Meets, ■ - Meets			
Chemical-Specific ARARs	□	□	□	■
Location-Specific ARARs	NA	NA	NA	■
Action-Specific ARARs	□	□	□	■
Other Criteria, Advisories, Guidance	□	◘	◘	■
LONG-TERM EFFECTIVENESS AND PERMANENCE	□ - No Protection, ◘ - Partially Protective, ■ - Protective			
Magnitude of Residual Risk - Human Health:	□	◘	◘	■
Magnitude of Residual Risk - Ecological:	□	■	■	■
Adequacy and Reliability of Controls	□	◘	◘	■
REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT	□ - Low or Reversible, ◘ - Moderate or Moderately Reversible, ■ - High or Irrreversible			
Treatment/Recycling Processes Utilized	□	□	□	◘
Amount of Hazardous Materials Destroyed or Treated	□	□	□	◘
Degree of Expected Reductions in Toxicity, Mobility or Volume:	□	□	□	◘
Irreversibility	□	□	□	■
Type and Quantity of [Process] Residuals	□	□	□	◘
SHORT-TERM EFFECTIVENESS	□ - High Impacts, ◘ - Moderate Impacts, ■ - Low Impacts			
Protection of Community and Workers During Remedial Actions	■	■	■	■
Environmental Impacts	■	■	■	◘
Time Until Remedial Action Objectives are Achieved	□	■	■	■
IMPLEMENTABILITY	□ - High Effort or Low Reliability, ◘ - Moderate Effort or Moderate Reliability, ■ - Low Effort or High Reliability			
Ability to Construct and Operate the Technology	■	■	■	◘
Reliability of the Technology	□	◘	◘	■
Ease of Undertaking Additional Remedial Actions, if Necessary	◘	■	■	■
Ability to Monitor Effectiveness of the Remedy	□	■	■	◘
Ability to Obtain Approvals from Other Agencies	■	■	■	■
Coordination with Other Agencies	■	■	■	■
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	■	■	■	■
Availability of Necessary Equipment and Specialists	■	■	■	◘
Availability of Prospective Technologies	■	■	■	■
COST				
Capital	$0	$70,000	$70,000	$2,997,000
O&M	$0	$16,000 /yr	$135,000 /yr	$95,000 yrs 1-3 only
Present Worth	$0	$338,000	$1,807,000	$3,247,000

□ **Low rating in comparison to other alternatives for specified criterion**

◘ **Mid-range rating in comparison to other alternatives for specified criterion**

■ **High rating in comparison to other alternatives for specified criterion**

TABLE K-6
COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR DEEP SEDIMENTS CORES LOCATIONS
RECORD OF DECISION
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

	Alternative DS-1: No Action	Alternative DS-2: Institutional Controls	Alternative DS-3: Removal and Off-Site Disposal
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	□ - No Protection, ◘ - Partially Protective, ■ - Protective		
Protection of Human Health	□	◘	■
Ecological Protection	NA	NA	NA
COMPLIANCE WITH ARARs	□ - Does Not Meet, ◘ - May Not Meet/Partially Meets, ■ - Meets		
Chemical-Specific ARARs	□	□	■
Location-Specific ARARs	NA	NA	■
Action-Specific ARARs	□	□	■
Other Criteria, Advisories, Guidance	□	■	■
LONG-TERM EFFECTIVENESS AND PERMANENCE	□ - No Protection, ◘ - Partially Protective, ■ - Protective		
Magnitude of Residual Risk - Human Health:	□	□	■
Magnitude of Residual Risk - Ecological:	■	■	■
Adequacy and Reliability of Controls	□	◘	■
REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT	□ - Low or Reversible, ◘ - Moderate or Moderately Reversible, ■ - High or Irrreversible		
Treatment/Recycling Processes Utilized	□	□	◘
Amount of Hazardous Materials Destroyed or Treated	□	□	◘
Degree of Expected Reductions in Toxicity, Mobility or Volume:	□	□	◘
Irreversibility	□	□	■
Type and Quantity of [Process] Residuals	□	□	◘
SHORT-TERM EFFECTIVENESS	□ - High Impacts, ◘ - Moderate Impacts, ■ - Low Impacts		
Protection of Community and Workers During Remedial Actions	■	■	◘
Environmental Impacts	■	■	□
Time Until Remedial Action Objectives are Achieved	■	■	□
IMPLEMENTABILITY	□ - High Effort or Low Reliability, ◘ - Moderate Effort or Moderate Reliability, ■ - Low Effort or High Reliability		
Ability to Construct and Operate the Technology	■	◘	□
Reliability of the Technology	□	◘	□
Ease of Undertaking Additional Remedial Actions, if Necessary	■	■	■
Ability to Monitor Effectiveness of the Remedy	□	■	◘
Ability to Obtain Approvals from Other Agencies	■	■	◘
Coordination with Other Agencies	■	■	■
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	■	■	◘
Availability of Necessary Equipment and Specialists	■	■	◘
Availability of Prospective Technologies	■	■	◘
COST			
Capital	$0	$44,000	$116,968,000
O&M	$0	$30,000 /yr	$100,000 yrs 1-3 only
Present Worth	$0	$459,000	$117,378,000

TABLE K-7
COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR SURFACE WATER
RECORD OF DECISION
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

	Alternative SW-1: No Action	Alternative SW-2: Monitoring	Alternative SW-3: Monitoring and Providing an Alternate Habitat
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	□ - No Protection, ◘ - Partially Protective, ■ - Protective		
Protection of Human Health	NA	NA	NA
Ecological Protection	□	□	◘
COMPLIANCE WITH ARARs	□ - Does Not Meet, ◘ - May Not Meet/Partially Meets, ■ - Meets		
Chemical-Specific ARARs	□	□	□
Location-Specific ARARs	■	■	■
Action-Specific ARARs	■	■	◘
Other Criteria, Advisories, Guidance	□	□	◘
LONG-TERM EFFECTIVENESS AND PERMANENCE	□ - No Protection, ◘ - Partially Protective, ■ - Protective		
Magnitude of Residual Risk - Human Health:	■	■	■
Magnitude of Residual Risk - Ecological:	□	□	◘
Adequacy and Reliability of Controls	□	□	◘
REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT	□ - Low or Reversible, ◘ - Moderate or Moderately Reversible, ■ - High or Irrreversible		
Treatment/Recycling Processes Utilized	□	□	□
Amount of Hazardous Materials Destroyed or Treated	□	□	□
Degree of Expected Reductions in Toxicity, Mobility or Volume:	□	□	□
Irreversibility	□	□	□
Type and Quantity of [Process] Residuals	□	□	□
SHORT-TERM EFFECTIVENESS	□ - High Impacts, ◘ - Moderate Impacts, ■ - Low Impacts		
Protection of Community and Workers During Remedial Actions	■	■	■
Environmental Impacts	■	■	◘
Time Until Remedial Action Objectives are Achieved	□	□	◘
IMPLEMENTABILITY	□ - High Effort or Low Reliability, ◘ - Moderate Effort or Moderate Reliability, ■ - Low Effort or High Reliability		
Ability to Construct and Operate the Technology	■	■	◘
Reliability of the Technology	□	■	◘
Ease of Undertaking Additional Remedial Actions, if Necessary	■	■	◘
Ability to Monitor Effectiveness of the Remedy	■	■	◘
Ability to Obtain Approvals from Other Agencies	■	■	■
Coordination with Other Agencies	■	■	■
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	■	■	■
Availability of Necessary Equipment and Specialists	■	■	◘
Availability of Prospective Technologies	■	■	■
COST			
Capital	$0	$0	$7,807,000
O&M	$0	$236,000 /yr	$236,000 /yr
Present Worth	$0	$3,226,000	$10,797,000

TABLE K-8
SUMMARY OF COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES
RECORD OF DECISION
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

MEDIUM	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment	Short-Term Effectiveness	Implementability	COSTS		
							Capital Costs	Annual O&M Costs	Present Worth
SURFACE SOIL (SS)									
Alternative SS-1: No Action	☐	☐	☐	☐	■	■	$0	$0	$0
Alternative SS-2: Institutional Controls	▣	■	▣	☐	■	■	$185,000	$30,000	$600,000
Alternative SS-3: Permeable Cover with Institutional Controls	■	■	▣	☐	▣	▣	$5,329,000	$48,000	$5,992,000
Alternative SS-4: Excavation and Off-Site Disposal	■	■	■	☐	▣	■	$47,172,000	$0	$47,172,000
Alternative SS-5: Excavation, Treatment, and On-Site Reuse	■	■	■	■	▣	▣	$22,993,000	$0	$22,993,000
SUBSURFACE SOIL (SUB)									
Alternative SUB-1: No Action	☐	☐	☐	☐	▣	■	$0	$0	$0
Alternative SUB-2: Institutional Controls	■	■	▣	☐	■	■	$315,000	$108,000 (yr 1-10) $30,000 (yr 11-30)	$1,276,000
Alternative SUB-3: Permeable Cover with Institutional Controls	■	■	■	☐	▣	▣	$6,495,000	$159,000 (yr 1-10) $81,000 (yr 11-30)	$8,070,000
GROUNDWATER (GW)									
Alternative GW-1: No Action	☐	☐	☐	☐	▣	▣	$0	$0	$0
Alternative GW-2: Pond Intercept with Monitoring and Institutional Controls	▣	■	▣	▣	▣	■	$432,000	$410,000 (yr 1-5) $205,500 (yr 6-30)	$3,918,000
Alternative GW-3: Plume Intercept by Groundwater Extraction, Treatment and Discharge and Monitoring with Institutional Controls	■	■	■	■	▣	▣	$4,739,000	$1,297,500 (yr 1-2) $1,040,000 (yr 3-30)	$19,137,000
Alternative GW-4: Plume Intercept by In-Situ Groundwater Treatment, and Monitoring with Institutional Controls	■	■	▣	▣	▣	☐	$13,089,000	$444,000 (yr 1-5) $222,000 (yr 6-30)	$17,792,000
HBHA POND SEDIMENTS (HBHA)									
Alternative HBHA-1: No Action	☐	☐	☐	☐	▣	▣	$0	$0	$0
Alternative HBHA-2: Monitoring	☐	☐	☐	☐	▣	■	$0	$144,000/yr 1-2 $70,000/yr 3-30	$1,201,000
Alternative HBHA-3: Subaqueous Cap	■	■	▣	☐	▣	☐	$3,160,000	$144,000	$5,291,000
Alternative HBHA-4: Storm Water Bypass and Sediment Retention with Partial Dredging and Providing an Alternate Habitat	■	▣	▣	▣	▣	▣	$5,419,000	$176,000/yr 1-3 $100,000/yr 4-30 $1,136,500 (every 5yrs)	$9,187,000
Alternative HBHA-5: Removal and Off-Site Disposal	■	■	■	▣	▣	▣	$3,560,000	$95,000/yr 1-3 only	$3,810,000
NEAR SHORE SEDIMENTS (NS)									
Alternative NS-1: No Action	☐	☐	☐	☐	▣	▣	$0	$0	$0
Alternative NS-2: Institutional Controls	▣	▣	▣	☐	■	■	$70,000	$16,300	$338,000
Alternative NS-3: Monitored Natural Recovery	▣	▣	▣	☐	■	■	$70,000	$135,000	$1,807,000
Alternative NS-4: Removal and Off-Site Disposal	■	■	■	▣	▣	▣	$2,997,000	$95,000/yr 1-3 only	$3,247,000
DEEP SEDIMENTS (DS)									
Alternative DS-1: No Action	☐	☐	☐	☐	■	▣	$0	$0	$0
Alternative DS-2: Institutional Controls	▣	▣	▣	☐	■	■	$44,000	$30,000	$459,000
Alternative DS-3: Removal and Off-Dite Disposal	■	■	■	▣	☐	▣	$116,968,000	$100,000/yr 1-3 only	$117,378,000
SURFACE WATER (SW)									
Alternative SW-1: No Action	☐	▣	☐	☐	■	▣	$0	$0	$0
Alternative SW-2: Monitoring	☐	▣	▣	☐	■	■	$0	$236,000	$3,226,000
Alternative SW-3: Monitoring and Providing an Alternate Habitat	▣	▣	■	☐	■	▣	$7,807,000	$236,000	$10,797,000

☐ Low rating in comparison to other alternatives for specificed criterion

▣ Mid-range rating in comparison to other alternatives for specificed criterion

■ High rating in comparison to other alternatives for specificed criterion

Table L-1: Groundwater Performance Standards

Carcinogenic Chemical of Concern	Cancer Classification	Performance Standards (ug/L)	Basis	RME Risk
Benzene	A	4	risk	1E-05
1,2-Dichloroethane	B2	2	risk	1E-05
Trichloroethene	C-B2	1	risk	3E-05
Arsenic	A	150	risk	4E-05
			Sum of Carcinogenic Risk:	9E-05
Non-Carcinogenic Chemical of Concern	**Target Endpoint**	**Performance Standards (ug/L)**	**Basis**	**RME Hazard Quotient**
Benzene	immune system	4	risk	0.1
Ammonia	respiratory	4000	HQ	1
1,2-Dichloroethane	kidney	2	risk	0.3
Trichloroethene	liver	1	risk	0.02
Naphthalene	general toxicity	5	HQ	1
Arsenic	skin	150	risk	0.3
			General Toxicity Hazard Index:	1
			Liver Hazard Index:	0.02
			Kidney Hazard Index:	0.3
			Immune System Hazard Index:	0.1
			Respiratory Hazard Index	1
			Skin Hazard Index:	0.3

Key

HQ = Hazard Quotient

Table L-2: Soil Cleanup Standards for the Protection of Day Care Child Direct Contact Exposures

Former Mishawum Lake Bed Area

Carcinogenic Chemical of Concern	Cancer Classification	Cleanup Standard (mg/kg)	Basis	RME Risk
Arsenic	A	50	HQ	4E-05
			Sum of Carcinogenic Risk:	4E-05

Non-Carcinogenic Chemical of Concern	Target Endpoint	Cleanup Standard (mg/kg)	Basis	RME Hazard Quotient
Arsenic	skin	50	HQ	1
			Liver Hazard Index:	1

Key

HQ = Hazard Quotient

Table L-3: FORMULA AND ASSUMPTIONS
ARSENIC SOIL CLEANUP STANDARD GOAL

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface and Subsurface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion/Dermal	Day Care Child	Young Child (ages 1-6)	Former Mishawum Lake Bed Area						
				IR	Ingestion Rate of Soil	200	mg/day	USEPA, 1997	Preliminary Remediation Goal (PRG) non-cancer =
				FI	Fraction Ingested	1	unitless	Prof. Judgement	$\frac{THI \times RfD/RBA \times BW \times AT\text{-}N}{ED \times EF \times CF \times [IR + (SA \times AF \times DAF)]}$
				EF	Exposure Frequency	150	days/year	USEPA, 1994	
				ED	Exposure Duration	6	years	USEPA, 1994	
				BW	Body Weight	15	kg	USEPA, 1997	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	USEPA, 1989	
				CF	Conversion Factor	0.000001	kg/mg	- -	
				SA	Skin Surface Area Available for Contact	2,800	cm^2	USEPA, 2004	
				AF	Skin Adherence Factor	0.2	mg/cm^2-day	USEPA, 2004	
				DAF	Arsenic Dermal Absorption Factor	0.03	- -	- -	
				RfD	Arsenic Oral Reference Dose	3E-04	mg/kg-day	- -	
				THI	Target Hazard Index	1	- -	- -	
				RBA [(1)]	Relative Bioavailability of Arsenic	site-specific	- -	- -	

References:
USEPA, 1989 - *Risk assessment guidance for Superfund. Volume I: Human health evaluation manual. Part A.* Interim Final. EPA/540/1-89/002. December 1989.
USEPA, 1994 - *Risk updates, no. 2.* USEPA Region I. August 1994.
USEPA, 1997 - *Exposure factors handbook.* Office of Research and Development. Washington, D.C. August 1997.
USEPA, 2004 - *Risk assessment guidance for Superfund Volume I: Human health evaluation manual (Part E, Supplemental guidance for dermal risk assessment), Final.*Office of Superfund Remediation and Technology Innovation. Washington, D.C. EPA/540/R/99/005

(1) Two different site-specific RBAs would be experimentally determined; one for surface soils and one for surface soils.

Table L-4: Sediment Cleanup Standards for the Protection of Recreational and Dredging Worker Direct Contact Exposures

Cranberry Bog Conservation Area: CB-03				
Carcinogenic Chemical of Concern	**Cancer Classification**	**Cleanup Standard (mg/kg)**	**Basis**	**RME Risk**
Arsenic	A	230	HQ	6E-05
			Sum of Carcinogenic Risk:	6E-05
Non-Carcinogenic Chemical of Concern	**Target Endpoint**	**Cleanup Standard (mg/kg)**	**Basis**	**RME Hazard Quotient**
Arsenic	skin	230	HQ	1
			Skin Hazard Index:	1
Wells G&H Wetland: WH, NT-3, 13/TT-27				
Carcinogenic Chemical of Concern	**Cancer Classification**	**Cleanup Standards (mg/kg)**	**Basis**	**RME Risk**
Benzo(a)pyrene	B2	4.9	background	1E-05
Arsenic	A	300	HQ	6E-05
			Sum of Carcinogenic Risk:	7E-05
Non-Carcinogenic Chemical of Concern	**Target Endpoint**	**Cleanup Standard (mg/kg)**	**Basis**	**RME Hazard Quotient**
Arsenic	skin	300	HQ	1
			Skin Hazard Index:	1
Sediment Cores: SC02, SC05, SC06, and SC08				
Carcinogenic Chemical of Concern	**Cancer Classification**	**Cleanup Standard (mg/kg)**	**Basis**	**RME Risk**
Arsenic	A	300	risk	1E-05
			Sum of Carcinogenic Risk:	1E-05
Non-Carcinogenic Chemical of Concern	**Target Endpoint**	**Cleanup Standard (mg/kg)**	**Basis**	**RME Hazard Quotient**
Arsenic	skin	300	risk	0.8
			Skin Hazard Index:	0.8

Key
HQ = Hazard Quotient